

Responses to Comments

Draft Parcel G Removal Site Evaluation Work Plan

Former Hunters Point Naval Shipyard, San Francisco, California

The purpose of this document is to address comments on the Draft Parcel G Removal Site Evaluation Work Plan, dated June 2018, for Former Hunters Point Naval Shipyard, San Francisco, California. The United States Environmental Protection Agency (USEPA), Department of Toxic Substances Control (DTSC), California Department of Public Health (CDPH), and San Francisco Department of Public Health (SFDPH) comments were received August 14, 2018 and are listed below with the responses to comments provided in bold. The work plan will be updated to address these comments and a draft final version submitted for review.

General Response

Thank you for your comments on the draft *Parcel G Removal Site Evaluation Work Plan, Former Hunters Point Naval Shipyard, San Francisco, California*, June 2018 and support of retesting as soon as possible. The Navy is committed to sampling every trench and survey unit where TtEC conducted work at Parcel G. The work plan has been updated to reflect the agencies' retesting approach based on the responses to comments herein, including removal of the durable cover and 100% surface scans of all trench and soil survey units; increasing the number of sample locations; and incorporating remediation based on the results of the initial testing. Updating background values will ensure cleanup of materials is based on site-related contamination rather than variations in background and naturally occurring radioactivity. The Navy is committed to performing excavation if site-related contamination is discovered.

As the regulators have noted throughout their comments, the radiological cleanup at HPNS presents a number of technical challenges. The remedial goals specified in the Parcel G ROD are very low compared with the observed ranges of naturally-occurring and anthropogenic radionuclides, making it difficult to differentiate between contamination from historical Navy operations and radioactivity that is already present in the environment.

The Navy believes a MARSSIM-based sampling approach would provide a solid basis for determining/confirming protectiveness and reducing uncertainty in the characterization of Parcel G in a more timely and effective manner.

The Navy will set aside their proposal for a MARSSIM-based sampling approach, incorporate the approach and methods proposed by the regulatory agencies, and accept the additional retest work effort that will be required.

The Navy is committed to incorporating an approach in which all agencies and stakeholders can agree. Therefore, the Navy has incorporated the regulatory agencies' retesting proposal into the work plan in the interest of gaining concurrence and collecting data as soon as possible.

USEPA Comments

General Comments

1. Executive Summary; Section 2, Conceptual Site Model; and other sections: The June 2018 draft Parcel G Removal Site Evaluation Work Plan ("Work Plan") acknowledges many aspects of the 2008 Conceptual Site Model (CSM) for storm drain/sewer lines that is cited in the Radiological Removal Action Completion Report (RACR) the Navy produced for Parcel G and other parcels. This 2008 CSM states that contamination could have come from any leaks in storm drain/sewer lines, which could have been a result of many factors that could have occurred at any locations along the lines. (See General Comment # 21 in the U.S. Environmental Protection Agency [EPA] December 2017 comments on the radiological data evaluation for Parcels B and G). The EPA, State of California Department of Toxic Substances Control (DTSC), and the California Department of Public Health (CDPH) found that the original test results from Tetra Tech EC Inc. are unreliable. Therefore, we are relying on the original 2008 CSM that states that "The potential for materials to migrate from piping/ and manholes into the surrounding soils is significant." The Executive Summary and Section 2, Table 2-1, "Uncertainties" section lists factors that could result in "Lower potential for radiological contamination than originally described in historical CSMs." While some of these factors could theoretically affect the extent of contamination potentially left behind by Tetra Tech EC Inc., until new reliable testing results are available, the 2008 CSM stands. This CSM was the basis for the EPA March 2018 comments on the Navy's February 2018 draft Work Plan for retesting any parcels.

In addition, the Executive Summary and Table 2-1 also refer to anthropogenic fallout as a potential source for Cesium 137 (Cs-137). Previous radiological work at the Hunters Point Naval Shipyard (HPNS) did not apply a reference background value for Cs-137 except in Parcel E-2. While the EPA has no objection to collecting new reference background data for Cs-137, please refer to this comment EPA previously submitted December 29, 2017, to the Navy about Cs-137 contamination due to Navy activity at Parcel G: "the Navy has found radiological contamination in portions of Parcel G, such as in the southeastern corner (associated with the buildings and the "peanut spill") and in the sewers along Cochrane Street due to previous testing during the Phase I through Phase V Radiological investigations/cleanups. The 2004 HRA [Historical Radiological Assessment] indicates that Cs-137 was found at high concentrations in sediment from a manhole along Cochrane Street." The HRA documents that the Navy used Cs-137, resulting in liquid waste that resulted in releases in Building 364 in piping, sinks, and the "peanut spill" behind the building. The HRA also documents in Table 5-1 that the Navy had 5 radioactive licenses with the Atomic Energy Commission for Cs-137, one for a quantity of 3,000 Curies and a separate quantity of 20 Curies of Cs-137. Two licenses indicate that Cs-137 was in sources. In some cases, the Navy made their own sources with Cs-137.

Please add to the Executive Summary text that Parcel G has contained Cs-137 contamination due to the Navy's activities. In Table 2-1, "Potential Source Areas" Section, please revise the text to indicate the sources related to Cs-137.

As a result of the above history, until receiving any evidence to the contrary, the underlying assumption should be that new comprehensive testing is necessary and that Cs-137 found in new testing could be due to Navy contamination. The regulators are open to evidence for an alternative CSM, such as new reliable data about the extent of contamination found after excavating the trench units (TU's) most likely to have contamination. Contamination is defined as radionuclide concentrations above the RGs in the 2009 Parcel G Record of Decision, excluding Naturally Occurring Radiological Material (NORM) or anthropogenic background. Excavation and testing of the soil survey units with the greatest likelihood of contamination is an important step toward testing the validity of the original CSM. Please ensure future versions of the Work Plan and the updated Master Sampling and Analysis Plan (SAP) address EPA's assumptions about the CSM.

The 2008 CSM is based on data collected by TtEC, which is unreliable; therefore, the Navy supports retesting the areas where TtEC conducted work as soon as possible. The results of the investigation activities presented in the Parcel G Work Plan will be used to update the CSM.

The CSM summary was removed from the Executive Summary because the level of detail needed for a comprehensive CSM is not relevant to an Executive Summary. In Table 2-1, the Site Operations and History discussion has been updated to note the Atomic Energy Commission licenses described in Table 5-1 of the HRA and that uses of Cs-137 that resulted in releases in and adjacent to Building 364. Discussion of the Phase I through Phase V investigations and cleanups has been added as a footnote to Table 2-1.

2. Executive Summary; Section 3, Soil Investigation Design and Implementation; and other sections: The June 2018 Work Plan does not include necessary elements of the retesting proposal presented in EPA's prior comments in March 2018. Based on the original 2008 CSM, EPA, DTSC, and

the CDPH proposed in March 2018 a scientifically driven retesting strategy that, if followed, is designed to provide confidence to the regulators and the public when the site would be suitable for redevelopment. The details appear in EPA's attached March 2018 comments. In addition, attached is a statistical review of the June 2018 Work Plan. For example, the Work Plan does not provide information about the path forward in a scenario in which contamination is found anywhere within the Phase I TUs or Survey Units (SUs). EPA stated in its March 2018 comments that if contamination is identified in any of the initial 33 percent (%) of TUs, then all the TUs in Parcel G (100%) will require excavation and testing. Similarly, for building site SU's, if contamination is identified in any of the initial 50% of SUs then all the similar units in Parcel G (100%) will require excavation and testing. Please revise the Work Plan to include this requirement. Similarly, Figure 3-2, Performance Criteria for Demonstrating Compliance with the Parcel G ROD – Soil, does not include a step in the logic diagram for the next steps to be taken if Ra-226 exceeds the RG (1.0 picoCuries/gram above background). Please revise Figure 3-2 to include a complete logic diagram demonstrating actions that will occur if Ra-226 is found to exceed the RG in any sample.

The work plan has been updated as follows:

- **In the Executive Summary and Introduction sections, the following text was added: “The phased investigation approach is based on the proposal by the regulatory agencies to achieve a high level of confidence that the Parcel G ROD RAO has been met for soil. For Phase 1, 100 percent of soil will be re-excavated and characterized at 33 percent of TUs in Parcel G. Soil sampling and scanning at the remaining 67 percent of trench units will be performed as part of Phase 2 to increase confidence that current site conditions comply with the Parcel G ROD RAO. The Navy will re-excavate 100% of Phase 2 TUs if contamination is identified in Phase 1 TUs.”**
- **The Executive Summary, DQOs (in Sections 3 and 4), and Section 5 have been revised to reflect the following:**
 - **If the investigation results demonstrate there are no exceedances based on a point-by-point comparison with the RGs, or that site conditions are representative of background and naturally occurring material, then a remedial action completion report (RACR) will be developed.**
 - **If the investigation results demonstrate exceedances of the RGs based on a point-by-point comparison with the RGs and are not representative of background and naturally occurring material, remediation will be conducted and a RACR will be developed.**
 - **The RACR will describe the results of the investigation and any remediation performed, compare the distribution of data from the sites with applicable reference area data, and provide a demonstration that site conditions are compliant with the Parcel G RAO.**

For the building site SUs, because 100 percent surface scans were added for all TUs and SUs, the building site SUs will all be investigated consistently and concurrently and there are no longer phases for surface soil SUs.

The Navy anticipates these additional actions will require the excavations to be open longer, requiring additional time for fieldwork.

3. Executive Summary; Section 3, Soil Investigation Design and Implementation; and other sections: The Work Plan proposes including cleanup criteria that are not documented in the Parcel G Record of Decision (ROD). The following sections contain language regarding additional cleanup criteria at Parcel G that are not documented in the Parcel G ROD and therefore do not meet the statutory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP) of 40 CFR §300.430 Remedial investigation/feasibility study and selection of remedy:
 - a. The Project Purpose section of the Executive Summary, states, “Portions of soil or structures at Parcel G that are not compliant with the RAO [Remedial Action Objective] specified in the Parcel G Record of Decision (ROD)] will be evaluated for protectiveness based on the United States Environmental Protection Agency’s (USEPA’s) current guidance on Radiation Risk Assessment at CERCLA Sites, Radiation Risk Assessment at CERCLA Sites (USEPA, 2014) [Radiation Risk Assessment at CERCLA Sites].” At this stage of the CERCLA process, the cleanup goals have already been legally established. A new Radiation Risk Assessment is ordinarily only performed as part of a Five-Year Review to evaluate whether or not the original RG’s are still protective. EPA has separately recommended that the Navy conduct this review, and, if any of the RGs are found to be no longer protective using the most current risk calculators, propose amendments to the Parcel G ROD to ensure protectiveness. For the current work plan, however, the current RGs still govern the cleanup and if any material is found on Parcel G that exceeds the RGs established in the Parcel G ROD for the ROCs, excluding naturally occurring and anthropogenic background, the material should be removed and disposed of in accordance with the ROD and other applicable laws and regulations.
 - b. The Executive Summary, Phase I discussion states, “To the extent practicable, soil with ROCs [radionuclides of concern] at concentrations above the RGs [remedial goals] will be evaluated further using USEPA’s current guidance on Radiation Risk Assessment at CERCLA Sites.” As stated above, pursuant to the ROD, the remedy at Parcel G requires that “[b]uildings, former building sites, and excavated areas will be surveyed after cleanup is completed to ensure that no residual radioactivity is present at levels above the remediation goals” and “[e]xcavated soil, building materials, and drain material from radiologically impacted sites will be screened and radioactive sources and contaminated soil will be removed and disposed of at an off-site low- level radioactive waste facility.”
 - c. The Data Evaluation and Reporting states, “If the investigation results demonstrate that site conditions are not compliant with the Parcel G RAO, then the data will be evaluated to determine whether site conditions are protective of human health using USEPA’s current guidance on Radiation Risk Assessment at CERCLA Sites (USEPA, 2014). A removal site evaluation report will be developed to include recommendations for further action.” EPA Directive 9200.4-40 was issued as guidance only and, as such, is not a regulatory requirement or a ROD-established cleanup level for the Hunters Point Naval Shipyard (HPNS) site in accordance with the CERCLA process as promulgated in 40 CFR §300.430. At Parcel G, the ROD has already established cleanup goals that govern the remedy. Please revise these sections of the Work Plan to state that only areas that are demonstrated to comply with the Parcel G ROD requirements will be eligible for Regulatory Agency approval and release.

All references to USEPA’s current guidance on Radiation Risk Assessment at CERCLA Sites (USEPA, 2014) were removed; however, the Navy believes it is appropriate to consider USEPA’s updated guidance. Changes to the cleanup levels are not proposed for this project.

4. Executive Summary and Section 3.4.4, Phase I Trench Unit Investigation: This section states that TUs will be over-excavated (i.e., excavated outside the estimated previous boundaries of the sidewalls and bottom), and will be gamma scan surveyed and sampled ex- situ (i.e., on a Radiation Screening Yard). The Work Plan Table 3-1, Phase 1 soil Trench Units indicates that the sidewalls and floor will be combined into one survey unit. The Navy’s proposal to excavate all soil beyond the previous boundaries will be more protective than EPA’s March 2018 proposal because more material will be excavated and tested instead of only systematic samples. In addition, scanning this material ex-situ will give more reliable results than scanning in-situ (i.e., in the trench itself). Therefore, EPA agrees with the Navy’s alternative proposal to address the potential for contamination to remain in the sidewalls and bottom of the trenches. However, please revise the Work Plan to specify that in the event that an exceedance above any of the ROD ROC RGs is identified in the ex-situ scanning, the Work Plan should require in-situ investigation, i.e., the sidewalls and floor of the associated trench be scanned and systematic samples should be collected and analyzed inside the trench to identify where contamination may still be present. Furthermore, please revise the Work Plan to specify that the source trench will not be backfilled before confirming if an exceedance is found in excavated material. If an exceedance is found, then the trench will not be backfilled until the in-situ scanning and sampling is done to identify the location of the exceedance and excavation of contamination is completed.

Table 3-1 has been updated to include the Phase 1 trench units identified by the USEPA (TUs 97, 98, 115, and 121). Table 3-1 has also been corrected to show the accurate number of expected sidewall and floor units (SFU), based on a maximum soil volume per survey unit of 198 yd³.

Text in the Executive Summary and throughout the work plan has been updated to conduct an in situ investigation of the open excavation if an exceedance not attributable to background in an SFU is found, and an in situ investigation and/or remediation will be performed prior to backfill. The in situ investigations will require excavations to be open longer and will extend the fieldwork period.

5. Executive Summary and Section 3.4.5, Phase 2 Trench Unit Design: Because the surface of the trench is the location closest to potential residents, EPA recommends treating the surface over each former trench or survey unit as a new soil surface survey unit to be tested using an approach similar to that used in previous HPNS radiological investigation Work Plans and in MARSSIM. This means that after removing the asphalt and any other cover material, 100% scanning and systematic sampling should be conducted. The number of cores must be no fewer than the number of systematic locations determined from a statistical evaluation consistent with the practices described in MARSSIM. Each core location is considered to be a single systematic sample location, even though multiple depths within the core may be analyzed. In the past, 18 samples has been used as a default, but this number should be calculated based on the variability in the data actually collected, which may result in a total number higher or lower than 18. These calculations should use the variability in the sample results obtained from the new background study. Please revise the Work Plan to specify the number of locations for core sampling locations must be determined as described in EPA's General Comment # 20 in its March 2018 comments.

Surface scanning of Phase 2 trenches has been added to the Work Plan. The Executive Summary and applicable sections of the text have been revised to reflect the calculation for a minimum number of 18 systematic sample locations for soil and static measurements for buildings. Based on assumptions of a relative shift of 2.0, Type I decision error rate at 0.01 and Type II decision error rate of 0.05, MARSSIM Table 5.3 recommends a minimum of 18 systematic samples for soil and static measurements for buildings in each survey unit. Therefore, 18 systematic locations for soil and static measurements for buildings are recommended as a placeholder until data from the reference background areas becomes available. The minimum number of samples/measurements per survey unit will be developed based on the variability observed in the background data. A retrospective power curve will be prepared to demonstrate the number of samples from each survey unit was sufficient to meet the project objectives. If necessary, additional samples may be collected to comply with the project objectives.

The Navy agrees that a MARSSIM is the best guidance for designing the radiological investigation. The MARSSIM framework for calculating appropriate numbers of soil samples and survey measurements was conservatively applied to the Phase 2 TUs in the draft work plan. However, the Navy has incorporated the regulators' sampling proposal to collect three times as many samples as required in the interest of gaining concurrence of the work plan and collecting data as soon as possible.

The inputs to the MARSSIM equations are primarily valid for the statistical tests for which they were designed. The Navy therefore believes that MARSSIM should be used to both design the survey and evaluate the data. However, the Navy has incorporated the USEPA's requirement for a point-by-point comparison in the interest of gaining concurrence of the work plan.

6. Executive Summary and Section 3.4.5, Phase 2 Trench Unit Design, Page 3-7: The text does not describe the percentage of land area for Phase 2 trenches that will receive gamma scanning. The Parcel G trenches should be treated as MARSSIM Class 1 trenches, as in previous HPNS radiological Work Plans, because of the CSM. The EPA stated in its March 2018 comments, "To address the potential exposure to future residents, 100% surface scans would be required. The Navy must first remove any asphalt cover and any imported fill that may have been used to achieve the desired grade, i.e. not part of backfill that potentially came from an area excavated by Tetra Tech EC Inc. Any locations where scan results exceed the investigation level would require collection of biased samples." Please revise the Work Plan to reflect this step.

Text in the Executive Summary and throughout the work plan has been updated to include 100 percent surface gamma scan of all TUs and SUs.

The Navy believes that the USEPA's statistical approach of conducting 100 percent scanning and sampling of 33 percent of the trench units is conservative. Although this approach provides sufficient confidence to confirm potential exposure to future residents, additional sampling of the remainder of the parcel was also requested to provide additional confidence. However, the Navy has incorporated the regulators' approach in the interest of gaining concurrence of the work plan and collecting data as soon as possible. This will extend the fieldwork period.

7. Section 1, Introduction: This section states that a separate Sampling and Analysis Plan (SAP) will be prepared for the investigation at Parcel G, however the SAP has not yet been provided for review. The revised and updated SAP should be issued for review by the Regulatory Agencies prior to initiation of work at Parcel G. Information provided in the Work Plan and the SAP and any other supplemental documents (e.g. any Task Specific Plans) should incorporate all of the technical, as well as quality control (QC) requirements for sample collection and analysis, data validation, assessment and reporting, along with copies of standard operating procedures for all of these processes. The technical information should include the method number, calibration information and quantitation parameters. The QC information should include daily/weekly efficiency, energy and background checks as applicable; and results for matrix spikes, duplicates, blanks, Laboratory Control Samples (LCS) samples, tracers (alpha spectroscopy), and the following method-specific parameters:

Gross alpha/beta Scans for Buildings Scan minimum detectible concentrations (MDCs) are below Investigation Levels for all radionuclides of concern (ROCs)

Gamma Scans, Gross alpha/beta Scans Scan MDCs are below the Investigation Levels for all ROCs

Gamma Spectrometry Static measurements or laboratory analysis

- Sample results should include all radionuclides detected along with count times, result, counting error, and isotope specific MDCs
- Demonstration that radionuclide-specific MDCs that are 10% of the ROC remedial goals (RGs) can be achieved.
- A copy of the gamma spectrometry analysis library

Alpha Spectrometry (See more detail in comment below)

- All Uranium and thorium isotopes by alpha spectroscopy for samples with elevated Ra-226, count times, results, counting and total propagated uncertainty, MDC, tracer recovery
- Demonstration that the (U)-234, U-235, U-238, Thorium (Th)-230, and Th-234 MDCs at 10% of the Radium (Ra)-226 RG can be achieved.

In summary, please ensure the Work Plan and SAP include all the specifics describing all radiation surveys, sample collection and analysis technical and QC requirements as described above. In addition, due to significant public interest, we recommend that the draft SAP be made available to the public for comment.

The Draft SAP was submitted for regulatory review on August 16, 2018. Information on analytical procedures and laboratory QC is provided in the SAP. For analytical methods (alpha spectrometry, gamma spectroscopy, and gas proportional counting for Sr-90), to the maximum extent practicable, MDCs will be below the RGs with a target of 10 percent to 50 percent of the RGs in accordance with MARSSIM. The MDCs are different for every sample (e.g., calculated per sample based on mass, activity, etc.), and any issues will be addressed on a case-by-case basis. For building surfaces, gross alpha and beta scan MDCs will be set at the RGs with a target of 50 percent of the RGs for static measurements. Also, see response to USEPA General Comment 19.

8. Section 3.1, Data Quality Objectives, Step 5 – Develop Decision Rules, Page 3-1 and Step 7 – Develop the Plan for Obtaining Data, Page 3-2; and Section 4.1, Data Quality Objectives, Step 5 – Develop Decision Rules, Page 4-1: The decision rules are not consistent with the EPA March 2018 comments and the requirements of the Parcel G ROD, which states, “Buildings, former building sites, and excavated areas will be surveyed after cleanup is completed to ensure that no residual radioactivity is present at levels above the remediation goals. Excavated soil, building materials, and drain material from radiologically impacted sites will be screened and radioactive sources and contaminated soil will be removed and disposed of at an off-site low-level radioactive waste facility.” The ROD requires excavation of exceedances based on a point-by-point comparison with the RGs. This approach is consistent with past practice and with USEPA national guidance. Please revise the approach to require excavation of any exceedances based on a point-by-point comparison with the ROD RGs, excluding background and naturally occurring material.

See response to USEPA General Comment 2. Although neither the ROD nor MARSSIM state that excavation is required based on point-by-point exceedances of the RGs, the Navy has incorporated the comment in the interest of gaining concurrence of the work plan and collecting data as soon as possible.

9. Section 3.3 and 4.3, Remediation Goals for soil and buildings, respectively: These sections list the current ROD RGs. The HPNS’s Five-Year Review occurring in 2018 is evaluating whether the current selected remedies, including these ROD RGs, are still protective and whether any changes are necessary to ensure continued protectiveness. Based on national practices directed by EPA headquarters, EPA expects this process to use the most current version of the EPA Preliminary Remediation Goal (PRG) Calculator and Building PRG Calculator to assess the ROD radiological RGs. The Work Plan should use only those cleanup goals confirmed through this analysis to be protective.

The Navy conducted preliminary calculations of the risk using the USEPA’s Preliminary Remediation Goal Calculator and found that the current RGs are within the risk management range of 10^{-4} to 10^{-6} . RGs are not proposed to be changed as part of this work plan. Future protectiveness will be evaluated in the Five-Year Review.

10. Section 3.3.1, Investigation Levels, Table 3-6, Soil Survey Measurement Investigation Levels: This section indicates that Investigation Levels are not applicable to the gamma scan surveys for Cesium (Cs)-137, and the footnote states that Cs-137 cannot be detected with the proposed gamma detector/gamma scan survey method at the RG of 0.113 pCi/g. Please describe how Cs-137 will be investigated in a manner that is compliant with a Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) survey design for which gamma scanning of 100% of the land area is completed with a detector capable of achieving the project-required detection limit and data quality objectives for the project. If the investigation will use alternative gamma measurement detectors with a better sensitivity that will allow Cs-137 to be identified at the RG above background (e.g. lanthanum bromide detector), then please revise the Work Plan to propose such a radioanalytical detection system. Alternatively, please revise the Work Plan to list the gamma scan survey achievable detection limit for Cs-137 and discuss how the survey(s) and sample collection will meet the data quality objectives for demonstrating that the survey unit is compliant with the ROD RG for Cs-137.

Example scan MDC calculations have been added to the work plan for both Cs-137 and Ra-226 in Section 3.5. Using best available technology, including large-volume crystals equipped with gamma spectroscopy, to perform gamma scans will improve the scan MDCs compared with traditional 2-inch by 2-inch gross gamma walk-over surveys; however, achieving an MDC at or below the Cs-137 RG is not possible for individual scan measurements based on the limitations of instrument detection sensitivity and NORM variability. Therefore, the gamma scanning survey design is based on the detection of Ra-226 at the RG.

Demonstrating compliance with the Cs-137 RG will be based on soil sample analytical results in comparison to the RG and background.

Clarification text has been added throughout the work plan.

11. Section 3.3.1, Investigation Levels: The proposed investigation levels are inconsistent with the methodology proposed for the gamma scan surveys. Section 3.3.1, Investigation Levels, states gamma scan surveys will be performed using detector systems equipped with gamma spectroscopy to provide real-time radionuclide-specific measurements, and the spectra will be evaluated using regions of interest peak identification tools for the ROCs that correspond to gamma rays at 186 kiloelectron volt (keV) for Ra-226, 609 keV for Bismuth-214 (bi-214), and 662 keV for Cs-137. However, the text does not state how the gamma scan can achieve sufficient detection limits for Ra-226 using the Ra-226 energy line at 186 keV due to the low efficiency at this energy or the Bi-214 609 keV line without a 21-day ingrowth period, especially when the investigation level is the same as the RG of 1 pCi/g above background. Additionally, Table 3-6 contains a footnote that states the gamma scan cannot achieve the detection limit necessary to detect Cs-137 at the RG of 0.113 pCi/g above background; yet the preceding text states that the gamma scan will be used to flag locations where Cs-137 exceeds the investigation level, defined in Table 3-6 as 100% of the RG, or 0.113 pCi/g above background. Please revise the Work Plan to address these concerns.

The work plan was revised for clarification and to require investigation levels that correspond to assumptions used to develop the scan MDCs.

12. Section 3.4.1, Number of Samples: Although under some circumstances, 18 samples per survey unit could be acceptable as a default starting point before sampling results are available, once these results are available, then the number of samples for subsequent survey units should be based on calculations using variability found in actual data. For example, EPA’s statistician used background data the Navy had previously collected from five reference areas and calculated that 25 samples per survey units would be needed to achieve your proposed 99% confidence level if soil from TUs/SUs are compared to reference background areas using a Wilcoxon Rank Sum (WRS) Test. EPA recommended starting with this default number of samples. Once new data are collected, they can also be used to recalculate the appropriate number of samples depending on the statistical tests which will be utilized to establish compliance. The new number of samples could be higher or lower than previously used.

Note that the variance from site investigative samples may be larger than the variance based on reference background samples, therefore the variance from samples collected in investigative survey units should be used to calculate the number of samples that should be collected in other investigative survey units. Also, variance should be determined using the same radioanalytical method as that which will be used for additional data collection. For instance, the variance for gamma spectrometry laboratory data should be used to determine the number of samples that are required for survey units where gamma spectrometry laboratory analysis will be conducted.

This section contains an inconsistent sampling scheme and does not comply with the requirements established in the Work Plan for number of samples required for each survey unit, as follows:

- a. It appears that the Work Plan does not provide the basis for the number of samples planned to be collected from TUs/SUs. The Navy previously issued a February 2018 Draft Work Plan, Radiological Survey and Sampling, which calculated the number of samples that would be collected from each SU using MARSSIM equation 5-1 for the WRS test. The Work Plan should use either the MARSSIM approach or other statistically based criteria for selecting the number of samples that will be collected from each SU so that conclusions based on evaluation of the SU data can be defined by a statistical level of confidence and as such, are usable for decision-making. Please revise the Work Plan to include this information.

See response to USEPA General Comment 5.

- b. This section specifies the collection of twenty-five subsurface samples from each RBA location and twenty-five surface soil samples from the off-site (RBA-Bayview) location, but only requires five surface samples be collected from each of the on-site RBAs. The text does not state how or why it is appropriate to collect only five surface samples from each of the on-site RBAs when twenty-five samples will be collected from the surface of the off-site location, and twenty-five samples will be collected from each of the RBA subsurface areas. For the Bayview park off-site

location, an important reason for sampling at this site is to get an indication of potential Cs-137 levels from fall-out, and to provide data that provides meaningful comparisons to on-site reference area data. Since on-site data will be collected from the surface and subsurface, the Work Plan should specify that both surface and subsurface data be collected from the off-site Bayview park location to provide a more complete and thorough evaluation of Cs-137 deposition and background levels in the San Francisco Bay area/the Hunter's Point Naval Shipyard. EPA understands that using a drill rig may present practical challenges to obtaining subsurface samples at the Bayview park location; therefore, the depth of subsurface samples collected will be based on the depth to which a hand auger can be used to collect the soil at the Bayview park. EPA appreciates the Navy's commitment to consult with a USGS Cs-137 expert in this process and in the field during sample collection. Please include this in the next version of the Work Plan and provide any comments from that expert in the eventual report that will be prepared about the sampling results.

The work plan does not commit to USGS involvement; however, if the USGS or another agency is consulted and provides input, it will be included in the report detailing the RBA data collection and results. Text has been added to the Soil Reference Background Area Work Plan to describe the number of samples calculation for the RBAs. Twenty-five surface and 25 subsurface soil samples will be collected from the offsite location (tentatively within the 312.5-acre McLaren Park).

- c. The fifth bullet indicates that the total number of samples to be collected for surface soils in the on-site RBAs is twenty-five, but the text states that five samples from each of the four on-site RBAs will be collected, which is only twenty samples, not twenty-five. The text in this section and the bulleted information should be revised to provide a consistent number of samples.

The text was updated to indicate that 25 surface and 25 subsurface soil samples will be collected from each RBA location.

- d. Appendix A, Section 4.1.2, states that based on the statistical evaluations, the RBA report will include recommendations for combining similar data sets, recommendations for selecting values or data sets representing background in soil, and conditions identifying situations when specific values or data sets may not be appropriate. Since statistical testing will be completed to determine if each of the RBA data sets are sufficiently comparable to combine the data, please revise the Work Plan to discuss how/why five data points is sufficient for identifying a population that can reliably be compared to another five-point data set to determine if the difference is statistically significant or not.

Text has been added to the Soil Reference Background Area Work Plan to describe the number of samples calculation for the RBAs. Twenty-five surface and 25 subsurface soil samples will be collected from each RBA location. This will result in up to 10 reference area data sets of 25 samples each from 5 different RBA locations (1 surface and 1 subsurface soil data set from each RBA location). The NRC criteria for providing characterization of a complex site, found in NUREG 1505 (Section 13.5, page 13-11, last paragraph, second sentence), states that "four reference areas each with between 10 and 20 samples in each should generally be adequate" (NRC, 1998). Based on Table 13.5, Power of the F-test when $\omega^2 = \sigma^2$ in NUREG-1505 guidance, 20 samples collected from each of six reference area data sets will provide 95 percent confidence that the reference area data sets can be combined if they are similar. The power of this test is 99 percent, meaning there is a 1 percent probability that the data sets will be incorrectly combined when they are not similar. The proposed survey design includes collecting 25 samples from each of up to 10 reference area data sets, providing a power greater than 99 percent while maintaining 95 percent confidence that the RBA data sets can be combined if they are similar.

Please revise the Work Plan to address these concerns.

See responses to comments a through d above.

13. Section 3.4.4, Phase 1 Trench Unit Design: The EPA, DTSC, and CDPH have prioritized trench units (TUs) for excavation using criteria listed in the EPA March 2018 Comments, e.g., Historical documentation of specific potential upstream sources, signs of potential falsification found in data evaluation, signs of data quality problems found in data evaluation, allegations from former workers, and regulators' independent field testing. More details about these criteria are in the March 2018 EPA comments. In addition, EPA previously made comments to the Navy about the categories of concern in a letter to the Navy on February 27, 2017. The regulators' prioritization is partially consistent with the Phase I Soil Trench Units identified in the Navy's draft Work Plan. We concur with Phase I TUs 69, 76, 78, 99, 101, 103, 104, 107, 108, 109, and 124. However, four of our highest priority TUs (TUs 97, 98, 115, and 121) are not included. These four TUs should be substituted for four of the 10 other TUs (i.e., those not listed above) that were identified as Phase I Soil TUs. Please make this change. The remaining soil TU's should be determined based on criteria such as those listed above, consistent with our March 2018 Comments and February 2017 letter that listed indicators of the highest likelihood of contamination. Choosing to prioritize a particular TU for logistical convenience due to TU's being adjacent is not an acceptable justification without independent evidence that this TU is among 33% of trench units most likely to have contamination based on the information we have to date.

The Phase 1 Trench Units were updated to include TUs 97, 98, 115, and 121 as recommended.

14. Section 3.4.6, Phase 1 Survey Unit Design, and Section 3.4.7, Phase 2 Survey Unit Design: For the Soil Survey Units in former Building Sites, the same relevant comments already made on Sections 3.4.4 and 3.4.5 about trench units also apply to building site survey units.

For the building site SUs, because 100 percent surface scans were added for all TUs and SUs, the building site SUs will all be investigated consistently and concurrently, and there are no longer phases for surface soil SUs.

15. Section 4, Building Investigation Design and Implementation: This section does not provide sufficient information to conduct a full evaluation of the sufficiency of the buildings investigation. The Navy's buildings data evaluation found significant enough extent of unreliable data that the Navy decided that none of the previous data could be used. Therefore, the presumption is that all previous work should be redone as a completely new investigation. Therefore, all specific details of a new building investigation/SAP should be provided in the Work Plan to adequately document the requirements of such an investigation. Please revise the Work Plan to specify a level of detail at least as thorough as typically done previously in Task Specific Plans for these buildings, as follows:

- a. Brief history of CSM along with a description of how survey units were identified and classified based on the CSM for each building, along with figures depicting the survey units and classifications, and sample locations.

The buildings selected for investigation will be those existing buildings in Parcel G identified as impacted in the HRA. Brief summaries of the operational history and potential for residual contamination for each building can be found in Table 2-1. A table was added to summarize SU classification for each building. Figures of the Class 1 SUs were included in Section 4 of the work plan and were updated to depict Class 2 and 3 SUs. Example sample locations are depicted on Figures 4-10 and 4-11.

- b. Complete listing of Data Quality Objectives (DQOs) for each Parcel, Survey Unit for land areas and for buildings

Building DQOs are provided in Section 4 and have been updated based on other comments.

- c. All MARSSIM Final Status Survey (FSS) design parameters, including the identification of the survey unit classifications and sizes, and number of samples required to be collected for the WRS test, and all the associated calculation inputs, including the Lower Bound of the Gray Region, standard deviation of previously collected data, relative shift, confidence level selected, etc. This information should also include the identification of investigation levels for all radiological survey types, elevated measurement comparison calculations, or any other inputs and decision rules associated with the FSS design. In addition, when multiple radionuclides may be present, the Work Plan should include the identification of the survey release limit and investigation level based on the sum of fractions and unity rule for all ROCs

Due to the lack of past investigation data and based on agency feedback, the survey unit boundaries and designations used in the previous surveys will be used for this investigation. As such, floor surfaces and the lower 2 meters of remaining wall surfaces will be designated Class 1 survey units and will not exceed 100 square meters in area. Remaining walls above 2 meters from the floor and remaining ceilings will be combined into Class 2 survey units and will not exceed 1,000 square meters in area. Additional building-specific detail has been added to the discussion of survey unit designation and classification in Section 4.4. The determination of the number of static measurements per survey unit has been expanded in Section 4.4 to follow MARSSIM methodology and to include all assumptions and calculations. The calculations of scan and static investigation levels can be found in Section 4.5. Since both gross alpha and gross beta measurements are recorded simultaneously, an RG of unity was used to derive the required number of static measurements. The sum of fractions and unity rule are part of a traditional MARSSIM approach to use assumed ratios of site ROCs to determine contributions to an overall dose or risk-based criterion. Consistent with USEPA General Comment 8, the approach for Parcel G is to compare individual sample results above the expected range of NORM or anthropogenic background to the RGs on a point-by-point basis, and the RGs are not based on the same dose or risk. Therefore, the use of sum of fractions and unity rule to review total risk is not appropriate for this approach.

- d. Description of the Investigation Levels or other triggers that will be used in Gamma Scan Surveys that would require a biased sample to be collected

Gamma scanning is not included in building investigations because all the ROCs are alpha and beta emitters. The calculations of alpha and beta scan and static investigation levels can be found in Section 4.5.

- e. Listing of the specific radiological instrumentation that will be used for each scan and static survey, exposure rate measurements, and laboratory measurements with the associated achievable MDC, required scan rates, count times (statics), minimum detectable count rate (MDCR) for surveys; smear/wipe sample instrument MDCs, and laboratory instrument MDCs. MDCs should be 10% of the Remedial Goals for all ROCs

Calculations for commonly used instruments and for all requested parameters can be found in Section 4.5. This section has been reviewed and revised for clarity based on other comments. For explanation of the MDCs, see response to USEPA General Comment 7.

- f. Inclusion of all the technical, as well as QC requirements for sample collection and analysis, data validation, assessment and reporting, along with copies of standard operating procedures (SOPs) for all of these processes. The technical information should include the method number, calibration information and quantitation parameters for scans, wipes, and static measurements. The QC information should include daily/weekly efficiency, energy and background checks as applicable; and results for duplicates, blanks, Laboratory Control Samples (LCS) samples (laboratory analysis), or matrix spikes and tracer recovery (only for destructive laboratory analysis) for each analysis type and instrument.

Information for commonly used instruments can be found in Section 4.5 to include efficiencies, calibration requirements, and daily performance checks. Referenced SOPs can be found in Appendix C. Because building survey data are compared to gross alpha and gross beta activity limits based on the lowest RG for any of the ROCs for that building, sampling and analysis for individual radionuclide activities are not included or necessary.

- g. Copies of field and laboratory radioanalytical methods/Standard Operating Procedures (SOPs). SOPs should include the sample/aliquot size and count times needed to achieve the project-required detection limits at 10% of the RG, the error bars associated with the quantitation of all radionuclides, the nuclide library that will be used to identify the ROCs in the analysis, the data reduction and reporting procedures, and all instructions required to complete the analysis.

Referenced SOPs can be found in Appendix C. Because data are compared to gross alpha and gross beta activity limits, sampling and analysis for individual radionuclide activities are not included or necessary. Because data are compared directly to the RGs, instruments must only be capable of detecting activity at or below the RGs. The survey design includes the goal of achieving static and swipe measurement MDCs that are 50 percent of the applicable RG. Reporting procedures can be found in Section 5.

- h. Reference to the appropriate Quality Assurance Project Plan (QAPP)/Master SAP which define all technical and quality parameters for data collection.

The SAP establishes the QA/QC requirements for the project. References to the SAP have been included in the work plan.

One possible approach the Work Plan could choose is to incorporate by reference some portions of the original Task Specific Plans for individual Buildings that are still relevant today, e.g. building description, building history, locations of survey units, extent of testing in categories of these survey units, etc. However, some other aspects of previous Task Specific Plans may need new scrutiny and potential modification in light of remediation that has already occurred, updated CSM information, new questions about reliability of prior work by Tetra Tech EC Inc., or other newly identified information.

Please revise the Work Plan to address the above specific issues for the buildings investigation.

16. Section 4, Building Investigation Design and Implementation: The Work Plan appears to depart from the previous practice of using the MARSSIM approach for identifying the parameters of a FSS in order to demonstrate that a survey unit has met the release criteria. The parameters defined by the MARSSIM approach include the survey unit class and size, and include calculations for determining the number of samples that would need to be collected in each survey unit to meet the assumptions of the WRS statistical test with a specified level of confidence. The WRS test uses hypothesis testing to identify if the median of the site data is statistically the same or different than the median of the background data and as such provides a comparison of populations. This approach is well-established and accepted among many agencies for demonstrating that a survey unit has met the release criteria (derived concentration guidelines level [DCGL]) as determined by pathway modeling and exposure assessment.

However, the EPA regulates cleanups in accordance with the CERCLA statutes which require demonstrating that regulatory standards and/or risk-based target cleanup levels for hazardous substances will not exceed a specified limit, or pose an Excess Lifetime Cancer Risk to a reasonably maximally exposed (RME) individual that exceeds the CERCLA risk range of 1×10^{-4} to 1×10^{-6} . Therefore, EPA has Superfund national guidance that recommends a more protective approach than MARSSIM in applying a point-by-point comparison between the investigative sample results and the RGs and which requires every exceedance of the RGs to be remediated. The more protective point-by-point approach has been used at the HPNS and most EPA Superfund sites nationwide for many years for both chemical and radiological cleanups. This approach must be included in this Work Plan. Even though this approach is more protective than what MARSSIM prescribes, the Work Plan should still use the MARSSIM approach to design the parameters of the FSS, as it has for many years, for consistency and defensibility of the results. Please revise the Work Plan to use the MARSSIM approach to design the parameters of the FSS and to require a point-by-point comparison between investigative sample results and the RGs, with remediation of areas where sample results exceed the RGs.

See response to USEPA General Comment 5. Using a point-by-point comparison is inconsistent with MARSSIM design parameters. MARSSIM was designed to achieve risk-based release criteria that is within the CERCLA risk management range, and the Navy maintains that MARSSIM is appropriate for the evaluation of data. However, the Navy has incorporated the comment in the interest of gaining concurrence of the work plan and collecting data as soon as possible.

17. Section 4, Buildings: The number of samples determined to be required for building survey units should be calculated using the MARSSIM approach for the design of an FSS, and should be based on parameters obtained from collection of site samples of the same media and survey or lab instrument. These parameters include an estimate of residual radionuclide concentrations and the variance (σ) of results within a given survey unit or units. The value of σ may be obtained from earlier surveys, limited preliminary measurements, or a reasonable estimate. The estimate of σ includes both the real spatial variability in the quantity being measured and the measurement method uncertainty of the measurement method. Therefore, the initial number of samples may be based on information from previously collected data or may be estimated; however as newly collected data is obtained under the Work Plan, the variance used to determine the appropriate number of samples needed to meet the assumptions of the WRS test should be updated based on the variance from the new data. In addition, since the variance is a measure of spatial variability and the measurement method uncertainty, it is important that the variance from the same radioanalytical technique be used to estimate the number of samples being collected for the same analysis type. For example, the variance from newly generated gamma static surveys should be used to calculate the number of static measurements required in other survey units where static measurements are will be used for the FSS data collection.

Likewise, the variance from laboratory analysis of survey unit samples should be used to calculate the required number of samples needed to be collected in other survey units where the samples collected for the FSS will be analyzed by the same method in the laboratory. If the variance from newly collected data is smaller than that obtained from historical data or assumptions made about the population, then fewer samples may be needed for sample collection in other survey units. Finally, the variance from scan, static, smear, or sample analyses in the laboratory can only be used for sample number calculations of the same media type. Therefore, the variance obtained from gamma static surveys on land areas should not be used to calculate the required number of samples that will need to be collected in buildings. Currently, the Work Plan does not discuss the specifics of what variance will be used to calculate the required number of samples, or how newly collected data will be used to update the variance and the required number of samples in the FSS for on-going survey unit investigations. Please revise the Work Plan to describe in detail how the required number of samples will be determined for building survey units.

See response to USEPA General Comment 5.

18. Section 4, Building Investigation Design and Implementation: In addition to the aforementioned deficiencies in the Work Plan Buildings investigation documentation, the following additional concerns require additional discussion, as follows:

- a. Section 4.1 (Data Quality Objectives) Step 5 – Develop Decision Rules states “If the investigation results demonstrate that site conditions are not compliant with the Parcel G RAO, then the data will be evaluated to determine whether site conditions are protective of human health using USEPA’s current guidance on Radiation Risk Assessment at CERCLA Sites (USEPA, 2014).” However, EPA Directive 9200.4-40 was issued as guidance only and is therefore not a regulatory requirement, nor does it satisfy the ROD- established cleanup level for the Hunter’s Point Naval Shipyard site in accordance with the CERCLA process as promulgated in 40 CFR §300.430. Please revise the Work Plan to state that only areas that demonstrate compliance with the Parcel G ROD requirements and are within the CERCLA risk range using the most recent version of the EPA PRG Calculator for radionuclides will be eligible for Regulatory Approval for release.

See response to USEPA General Comment 3 and 9.

- b. The Work Plan does not explain why some buildings or portions of buildings will receive surveys and others will not. The Historical Radiological Assessment (HRA) Volume II should be used to summarize information about all buildings within Parcel G to provide justification for which buildings/areas will be surveyed. In addition, the justification should also include documentation from the data evaluation forms and conclusions regarding allegations of misconduct and fraud by the previous contractor, as well as Regulatory Agency input to this analysis.

A summary of each building and survey unit has been added to Section 4, including the rationale for which areas will be surveyed.

- c. The text does not explain why MARSSIM Class 2 areas were not proposed around Class I areas when the entire building will not be surveyed.

See response to USEPA General Comment 15c.

- d. The Work Plan does not provide justification for selection of the area in Building 401 where background data will be collected.

The building RBA has been changed to Building 404. Background reference area(s) for each investigated surface material will be established in Building 404, which is an unoccupied and unimpacted former supply storehouse in Parcel G. Building 404 was constructed in 1943 (HRA Reference 1598), and is a single-story building with concrete floors, wooden superstructure, and prepared roll or composition roof. The dimensions are 243 feet by 209 feet by 22 feet with 43,695 square feet of floor space and a total volume of 779,900 cubic feet.

- e. The Work Plan does not discuss how the number of static measurements for each survey unit was calculated.

See response to USEPA General Comment 5.

- f. The Work Plan does not state if additional wipe samples may be sent to the laboratory for destructive analysis for speciation to determine which radionuclide is contributing to the radiation if release limits are exceeded for either gross alpha or gross beta.

Wipes will not be sent offsite for isotopic analysis but will be stored for potential future analysis. Locations found to exceed the RGs and not shown to be NORM or anthropogenic background will be remediated.

- g. The Work Plan includes a listing of the investigation levels but does not specify whether exceedance of the investigation levels will result in the collection of bias samples or static measurements in buildings.

Locations found to exceed the investigation levels will be investigated to determine the areal extent of that exceedance as described in Section 5.3.

- h. The Work Plan does not specify collecting data from locations where measurements and/or sampling may be necessary due to use of equipment, areas where potential cross contamination may have occurred, or where waste disposal practices may have resulted in contamination in sinks, or drains. Examples include items of equipment and furnishings, building fixtures, drains, ducts, and piping. Many of these items or locations have both internal and external surfaces with potential residual radioactive material which should be surveyed for removable and fixed contamination.

Surveys of impacted building materials and equipment are specified in Section 4.6.3.6. This section has been revised to add detail on the planned process for material and equipment surveys.

Please revise the Work Plan to address these concerns.

19. Section 5.4 NORM Background Evaluation: The proposed approach for performing a Naturally Occurring Radioactive Material (NORM) evaluation for site samples is insufficient for ensuring a complete and defensible analysis. The Executive Summary discussion of Data Evaluation and Reporting states "individual samples with gamma spectroscopy concentrations for Radium-226 (Ra-226) greater than the RG will be analyzed for Uranium-238 (U-238) and Ra-226 using comparable analytical methods. For that specific sample, the U-238 result will be used as a more representative estimate of the background value for Ra- 226, and the Ra-226 concentration will be compared to the RG for Ra-226 using the revised background value." Per previous EPA comments, a sample with elevated Ra-226 above the RG should be analyzed for all uranium and thorium isotopes by alpha

spectroscopy, and should be compared to data obtained in the gamma spectrometry analysis for all the radionuclides listed in the Appendix A, Table 3-6, Analytical Sample Summary. This information is required due to the following reasons:

- a. U-238 results often have a large error bar/uncertainty associated with the result; therefore, analysis of other radionuclides in the U-238 decay series should be performed to confirm the accuracy of the U-238 result.
- b. The alpha spectroscopy analysis for U-238 will also provide results for U-235 and U-234. All of the uranium isotopes reportable by alpha spectroscopy, including U-238, U-235, and U-234 should be reported in order to evaluate if the three uranium isotopes ratios indicate the uranium is present in natural abundance with uranium-238 at 99.2739–99.2752%, uranium-235 at 0.7198–0.7202%, and uranium-234 at 0.0050–0.0059%.
- c. Alpha spectroscopy analysis of thorium isotopes (Th-230 and Th-234) is requested to confirm the Uranium-238 result since Th-234 is the first daughter product of U-238. In addition, Th-230 is the immediate precursor to Ra-226 in this series; therefore, analysis of this isotope will help confirm whether the U-238 decay series is in equilibrium.
- d. Gamma spectrometry analysis for Bismuth and Lead isotopes that are part of the Thorium and Uranium decay series. Potassium-40 (K-40) will provide further evidence of whether the ROCs detected in the analysis are from naturally occurring background or represent contamination.

Please revise the Work Plan to require all samples with elevated Ra-226 results to be analyzed for all Uranium and Thorium decay series isotopes by alpha and gamma spectroscopy to provide sufficient documentary evidence regarding the NORM evaluation.

Section 5 has been revised to require alpha spectroscopy for U-238, U-234, Th-230, and Ra-226 to evaluate the equilibrium status of the uranium natural decay series in order to assist in the comparison of Ra-226 results with background for all samples exceeding the RG and background. Please note that U-235 is not part of the U-238 decay series and cannot be used to evaluate equilibrium conditions. While Th-234 is part of the uranium decay series, it is a beta-emitter and analyses will not provide comparable data.

20. Section 5.6, Reporting, Page 5-7: The text indicates that where a TU/SU exceeds the Parcel G ROD RAOs, the Removal Site Evaluation Report will include recommendations and options for further action, including the possibility of revising the Parcel G ROD to demonstrate the unit has met compliance criteria. However, the current compliance criteria are the Parcel G ROD RGs. Unless the Navy performs an analysis that demonstrates that the current RGs are no longer protective (for instance, by evaluating the RGs using the most current EPA PRG calculators), an amendment to the Parcel G ROD would be unnecessary. Therefore, please revise Section 5.6 to remove reference to revision of the Parcel G ROD as a potential solution to demonstrating a TU/SU meets the release criteria in the Work Plan.

The text regarding revisions to the Parcel G ROD was removed.

21. The Appendix A, Soil Reference Background Area: This section does not reference a Quality Assurance Project Plan (QAPP) or a task-specific work plan/sampling and analysis plan (TSP/SAP) which specifies the details of all quality and procedural requirements for this data collection project. Please revise Appendix A to include this information.

The SAP provides QA/QC requirements, and a reference was added to the text.

22. Appendix A, Soil Reference Background Area: It is unclear whether the proposed background locations are suitable for collection of background samples because the Work Plan does not provide details about these locations. For example, it is unclear if there were any previous excavations (e.g., exploratory excavations, remedial excavations, fuel line removals, or sanitary sewer/storm drain removal excavations) in these areas. If any of these areas have previously been excavated, then it would be unsuitable for use as a reference background area (RBA). In addition, the location proposed in Parcel D-2 is near the foot of a steep slope where erosion and run-off may have concentrated radionuclides found in atmospheric fallout like Cs-137; if this is the case, this location is unsuitable as a background location. Further, the location proposed for Parcel UC-2 is near or at the bottom of a hillside, where runoff may also have concentrated Cs-137 and be unsuitable for use as a background site. Although the text describes these areas as "non-impacted," a detailed justification for each proposed background area should be provided. Please revise the text to include a detailed justification for each proposed background location and exclude any locations where erosion and runoff may have concentrated radionuclides found in atmospheric fallout.

Text has been added to justify selection of the non-impacted RBAs. The proposed RBAs located in Parcels D-2 and UC-2 were previously accepted for use as suitable RBAs because of their status as unimpacted and representative of conditions across Hunters Point. These locations have been covered with asphalt (durable cover) following the previous characterization, preventing additional depositing of Cs-137 attributable to erosion. Erosion and runoff are natural processes that should be characterized to establish variability in background.

23. All sections: EPA appreciates the multiple technical meetings with the Navy to discuss these comments and the verbal commitments from the Navy to revise the Work Plan to address many of these comments. We look forward to seeing the revised Workplan that incorporates these changes. EPA is making every effort to include in our formal comments every concern that we may have. If significant new information comes to light, including related to public comments, or significant new insights result from further evaluation, EPA may supplement these comments later.

Comment noted.

24. All Sections: Attached is a statistical review of the Work Plan that applies to all sections of the Workplan.

The Navy agrees with many of the points raised in the USEPA's statistical review. The rationale for the number of samples has been updated in the text. Multiple lines of evidence, including statistical and graphical comparisons with background, will be used for evaluating site data. Although the Navy agrees that MARSSIM statistics (e.g., the WRS test comparing two data sets to determine compliance with a release criterion), as indicated in the USEPA's statistician's review, are a valuable tool for evaluating data and decision-making, they are in conflict with USEPA General Comments 8 and 16, which require a point-by-point comparison with the ROD RGs, excluding background and naturally occurring radioactive material.

Statistical Review - Specific Comments – Parcel G

Executive Summary - Soil Investigations, 3rd paragraph, pg IV - "A phased investigation approach is presented in this work plan that was designed to provide a high level of confidence that current site conditions either comply or do not comply with the Parcel G ROD RAO (Navy, 2009)." As presented, the Draft Work Plan does not provide a means for quantifying the confidence associated with establishing compliance/non-compliance of Parcel G.

Discussion: Refer to Parcel G- General Comments of this TM for a detailed discussion. As stated earlier, it is widely recognized (MARSSIM 2002; NUREG-1505 Rev. 1) that statistical confidence is a critical component in establishing a defensible decision that a radiological site is in compliance. It is highly recommended that the Navy incorporate statistical testing into their data quality objectives (DQOs) so that conclusions drawn from this sampling effort can be substantiated and defended.

Although the Navy agrees that MARSSIM statistics (e.g., the WRS test comparing two data sets to determine compliance with a release criterion) are a valuable tool for evaluating data and decision-making, they are in conflict with USEPA General Comments 8 and 16, which require a point-by-point comparison with the ROD RGs, excluding background and naturally occurring radioactive material.

Introduction - fourth paragraph, pg. 1-1: Additional information has been collected since the original Basewide Radiological Management Plan was designed. Historical data from background sampling can now provide a measure of expected variability for the soils on Parcel G and assist in the statistical design (sample sizes, statistical testing) of the Parcel G assessment and the reference background study. This historical information is relevant to the current conditions on the Parcel, including the Conceptual Site Model, and should be incorporated in the overall design of the assessment.

The background data were collected by Tetra Tech EC; therefore, collection of new background data is proposed to update the CSM.

Section 3.4 -Radiological Investigation, third paragraph: Please provide justification for how the number of TUs, to be excavated and undergo Phase I sampling, analysis, and scanning activities, was selected. What is the justification for only choosing 42 TUs of the 63 present in Parcel G? Similarly, how was the number of SUs determined for the Phase 1 investigation? The original assessment work conducted on Parcel G included the excavation of 100% of the TUs to meet the ROD RAO. Given the uncertainty of the historical sampling results and alleged data manipulation, what is the justification and supporting evidence for not excavating 100%?

See USEPA General Comment 2. The number of Phase 1 and Phase 2 trench units was provided by the USEPA.

Section 5.5 -Reference Background Area Soil Data: It is unclear to this reviewer how the proposed comparison of background data and TUs will establish if an RBA is representative of on-site soils. As presented, this methodology is used for comparing duplicate sample results per the Multi-Agency Radiological Analytical Protocols Manual (MARLAP) not for comparison of two populations. Please provide a reference/guidance document that supports the use of this test to indicate a measure of representativeness when comparing two populations.

Section 5 has been revised, and the referenced section was removed.

Statistical Review - Specific Comments – Establishing Background -Appendix A

Section 2. Purpose and Data Quality Objectives, pg. 2-2, 3rd and 4th bullets – The Kruskal-Wallis (KW) test is the non-parametric equivalent of a one-way analysis of variance (ANOVA) and is conducted on ranked data.

1. The KW test can be used on data sets which contain non-detect (ND) data if all the NDs are below the largest detected value.

Recommendation: Add text that this assumption will be verified prior to running the KW test and provide an alternate statistical test or methodology if current/historical information or professional experience regarding the laboratory analysis of the ROCs indicate this assumption will not be met.

2. The null and alternate hypotheses of the KW test are based on the median of the data. In this case, the null hypothesis for each ROC is that the medians of all RBAs are equal, with the alternative hypothesis being that the median of at least one group is not equal to the medians of the other groups. It does not identify which, if any, of the RBAs are different from the others.

Discussion: Please provide details on how the Navy will determine which RBA is statistically different from the others if the null hypothesis is rejected. Which post hoc test will be utilized?

RBA data will be reviewed graphically (e.g., histograms and box and whisker plots) to identify observed differences. Additional statistical testing between different data sets and populations may also be performed. Appendix A, Section 4.2, has been updated to provide additional details on the analysis of RBA data.

Section 3.1.4 Number of Samples, pt paragraph, pg 3-3 - "The NRC Criteria for providing characterization of a complex site, found in United States Nuclear Regulatory Commission Regulation (NUREG) 1505 (NRC, 1998) is at least 100 samples from at least 5 distinct locations."

Discussion: Please provide a specific page number/citation from NUREG 1505 that supports the sample size and number of distinct locations cited in the above statement. This reviewer cannot locate that recommendation within the NUREG cited. Further specification is required on how these numbers were derived: what assumptions were made, what inputs were used in the calculations, what data quality objective drives the sample size, cite a look-up table if one was used, etc.

See response to USEPA General Comment 12d.

Section 3.1.4 Number of Samples, Bulleted Sample Sizes, pg 3-3 - The proposed sample sizes include 25 subsurface samples from each on-site RBA, 5 surface samples from each on-site RBA and 25 surface samples from the off-site Bayview RBA.

Discussion: Section 2 of the Draft Soil RBA Work Plan states that the RBAs, on-site and off-site, will be compared using a KW test. The fact that the Bayview Area sample size is five times greater than the on-site RBAs will compromise the outcome of the comparison. As stated earlier in this document, it is recommended that 25 surface soil samples be collected from each RBA unless statistical calculations can be provided that support 18 samples are sufficient to achieve power and a 99% confidence level for TU to RBA comparisons. This also provides a sufficient number of samples for between RBA comparisons. See the discussion for Section 4.2.3 later in this document for further justification of increasing sample sizes within each on-site RBA.

Additionally, it is recommended that subsurface sampling also be conducted at the Bayview RBA to provide a comparison of the stratification of ROCs at depth with the on-site RBAs, visually and analytically.

See response to USEPA General Comments 12b and 12d.

Section 3.1.5.1 RBA-1 through RBA-4, 1'1 paragraph, pg 3-3 - The geographical dimensions of the RBAs have been reduced significantly from the initially proposed dimensions in the February 2018 Draft Work Plan. Reducing the size of the area also reduces the probability of capturing the variability of ROC concentrations that is present across the originally selected RBA area.

Discussion: It appears that the areas were reduced to justify the collection of only 5 surface soil samples within each area so as not to saturate the new 20 foot by 20 foot square RBAs. As stated earlier in this TM, sample sizes per RBA per soil depth should be consistent with the sample sizes of the individual TUs/SUs. The original sizes of the RBAs should be re-established allowing for the greater number of samples to be collected at surface in a systematic way that represents the entire RBA not just a 20 x 20 foot area.

See response to CDPH Specific Comment 65.

Section 4.2.3 Determine of Statistical Differences between Data Sets, 3rd paragraph, pg 4-4 - "The RBA data sets will be compared to each other by applying the KW test, detailed in Section 13.2 of NUREG-1505 (NRC, 1998) and described in Section 4.1.3, to determine whether the reference areas have similar or significantly different background levels. "

Discussion: Per NUREG-1505 Rev. 1 Table 13.5 shows that a minimum of 20 samples must be collected per RBA if 5 RBAs are selected for establishing background at an $\alpha=0.05$ and power =97.6%. The Draft Work Plan presented by the Navy in February 2018 indicated that confidence levels would be set at $\alpha=0.01$ and power=99%. To achieve those levels of confidence and power more than 30 samples would need to be collected per RBA per Table 13-5 of NUREG-1505, Rev. 1.

See response to USEPA General Comment 12d.

Specific Comments

1. Executive Summary: The next draft of the Work Plan will receive a great deal of attention from the public. Laypeople reading it would benefit from a summary that is more understandable to a general audience, e.g. similar to the fact sheet that the Navy already distributed June 2018 to accompany its draft Work Plan. EPA recommends that the Navy update its fact sheet to reflect the next draft version of the Work Plan, distribute that updated fact sheet to the public, and insert the updated fact sheet into the beginning of the next draft before the Executive Summary.

The fact sheet was updated in October 2018 and is available.

2. Executive Summary, p. iii, and Table 2-1, Conceptual Site Model – Uncertainties, Page 2-5: The Executive Summary references “Allegations of previous sample collection fraud, . . .” and the Table references “Potential for data manipulation or falsification.” Yet some instances of these practices have been confirmed by the 2014 Tetra Tech EC Inc. Internal Investigation, the 2016 Nuclear Regulatory Commission concluded enforcement action, and the 2018 Department of Justice concluded criminal cases that sent two people to prison. Please add language to state that some fraud, manipulation, falsification, etc. have been confirmed.

The text has been updated throughout to clarify references to allegations.

3. Section 1, Introduction: For context to the reader, please clarify that other future work plans will address other aspects of the site where Tetra Tech EC Inc. has previously performed radiological work. For example, EPA commented in March 2018, “Tetra Tech EC Inc. also conducted radiological cleanup work in ship berths. The Navy should also address potential contamination in this and any other category of past radiological work by Tetra Tech EC Inc. at the HPNS.” Please insert language into the Work Plan to convey this larger context into the introduction.

A sentence has been added to indicate that future work plans will address soil and buildings in the other parcels (B, C, D-2, E, UC-1, UC-2, and UC-3), including the North Pier and Ship Berths.

4. Table 2-1, Conceptual Site Model – Uncertainties, Page 2-5: The Uncertainties section of Table 2-1 states storm drains and sewer lines, including one foot of soil surrounding the pipes were removed to within 10 feet of all buildings, and impacted buildings had the remaining lines removed during surveys of the buildings. Non-impacted buildings are stated to have had surveys performed at ends of pipes and were capped. However, review of the Parcel G Data Evaluation Forms identified several instances of pipes being found in areas where they were thought to have previously been removed.

Please revise the uncertainty discussion in the Table 2.1 Conceptual Site Model to list this additional uncertainty.

Please clarify where “pipes being found in areas where they were thought to have previously been removed” or where in the Parcel G Data Evaluation Forms this information was found.

5. Table 2-1, Conceptual Site Model – Uncertainties, Page 2-5: The “Uncertainties” section states that an example of a factor that results in a lower potential for radiological contamination is power washing. However, the “Potential Migration Pathways” section on Page 2-4 of the same table lists power washing also. Furthermore, the Navy’s 2008 Technical Memo, Section 3b. Conceptual Site Model, states that power washing increases the potential for cracks in piping that could increase seepage of radiological material into the surrounding soil. These appear to contradict. Please remove power washing from the list of factors that could lower the potential for radiological contamination.

The text was removed as requested.

6. Section 3.3 and 4.3, Remediation Goals for soil and buildings, respectively: Please revise the Work Plan to explain how compliance with RGs will be evaluated when more than one ROC is identified. Cleanup goals should include an analysis of the sum of fractions and the unity rule to ensure total risk to the Reasonably Maximally Exposed (RME) individual posed by multiple ROCs in soil or buildings does not exceed the CERCLA risk range of 1×10^{-4} to 1×10^{-6} . Please note that “Consistent with existing Agency guidance for the CERCLA remedial program, . . . EPA generally uses 1×10^{-4} in making risk management decisions.”

See USEPA response to General Comment 15c.

7. Section 3.3.1, Investigation Levels: This section defines investigation levels as media- specific, radionuclide-specific concentrations, or activity levels based on the remediation goals (RGs) that trigger a response, such as further investigation, if the investigation level is exceeded. The text also states that investigation levels are established for each instrument and vary with SU classification and measurement type. It is unclear, however, why the investigation levels may vary by survey unit. Please remove text that indicates that the investigation levels would vary by survey unit.

The text was removed.

8. Section 3.4, Radiological Investigation Design: The Parcel G Work Plan does not consider the need to investigate contamination associated with radiological objects containing Strontium-90. A gamma scan survey can be used to detect the bremsstrahlung radiation caused by Sr-90, but the text does not discuss collection of this data. Please revise the Parcel G Work Plan to discuss how the potential presence of Sr-90 in soil will be assessed.

Instrument-specific details on how gamma scan data will be evaluated have been added to the work plan. Sr-90 contamination in soil is not expected to produce bremsstrahlung radiation to be detected by gamma scanning; however, the bremsstrahlung radiation produced by an intact radioluminescent Sr-90 deck marker should be detected using a full energy spectrum window. The text has been revised to note the potential causes for gamma scan anomalies (e.g., Sr-90 or Ra-226 deck markers, localized soil contamination, and elevated NORM) and how they will be investigated.

9. Section 3.6.2.2, Site Preparation, Page 3-13: The second to the last bullet point states that after removal of the durable cover, “an additional 1 foot of durable cover buffer beyond the former excavation surface boundary will be removed,” but the Navy response to EPA Specific Comment 16 states that “anything removed will be surveyed.” Please revise the text to discuss whether excavation of this additional foot of soil is sufficient to account for regrading and clarify if this soil will be scanned and sampled or sorted.

To account for regrading, the removal of an additional 1 foot of asphalt on either side of the historical trench locations will allow for a sufficient buffer for excavation of trench materials. If trench boundaries extend laterally further than expected, additional asphalt will be removed. As noted in the text, durable cover materials, including asphalt, will be stockpiled and radiologically screened prior to disposal. The trench profile shown on the inset of Figure 3-4 has been updated to show the portions of the durable cover that will be removed.

10. Section 3.6.4, Phase 2 Trench Unit Investigation: Three samples should be collected at each core, including those less than 4 feet in depth below ground surface (bgs). Please revise this section to specify three samples will be collected for each core regardless of the depth of the core.

The text was revised to state that three samples will be collected from all borings. See response to USEPA General Comment 5.

11. Section 3.6.3.1, Automated Soil Sorting System Process, Page 3-15: It is unclear if a single sample of the diverted soil material will be sufficient to characterize this material, particularly if there is a large volume of diverted soil. Since soil can be diverted for reasons other than radiological alarms (e.g., low mass on the conveyor belt), it is important to collect sufficient samples to characterize this soil. Please revise the Work Plan to propose a volume-based sampling protocol with a one-sample minimum to characterize diverted soil.

Text has been added to clarify the sampling requirements. If soil material has been discharged to the “Diverted Pile,” an investigation of the potential area of elevated activity (i.e., the “Diverted Pile” material) will be conducted. At a minimum, the soil sorting reporting software results will be reviewed to identify the causes for diverting material, and biased soil sample(s) will be collected. The biased soil sample(s) will be collected from the soil material that has been discharged to the “Diverted Pile” bin at a frequency equal to the volumetric frequency of sampling for ESU or SFU material. Using the current minimum number of systematic samples in a given unit (18), with a maximum size of 198 yd³, a sample is collected roughly every 11 yd³, with a minimum of 1 sample if the volume is less than 11 yd³.

12. Section 3.6.3.1, Automated Soil Sorting System Process: This section provides a description of one alternative for gamma scans to screen soils from TUs/SUs at Parcel G, but clarification is needed:

- a. Please include a description of the detectors that will be used or the detection limits of those detectors.
- b. The text states that soils will be sorted based on radiological properties. Please provide specifics about which radiological properties will be monitored and used for segregation. Please explain if the alarm will be set to an investigation level or if it will be set at multiple levels such that alarms occur when one of the ROC RGs or investigation level is exceeded.
- c. This section indicates the details of such an operation are included in the Soil Sorting Operations Plan, but this Plan was not included in the Work Plan. If this option is chosen, the Soil Sorting Operations Plan should be submitted for Regulatory Agency review and approval before soil sorting is implemented.

Please revise the Work Plan to address these concerns.

The minimum requirements for the soil sorting system detectors, MDCs, and diversion settings were added to the work plan. The specific soil sorting configuration will be provided by the contractor who is performing the Parcel G investigation in a separate Soil Sorting Operations Plan that will be submitted to the regulatory agencies for review and concurrence.

13. Section 3.6.4, Phase 2 Trench Unit Investigation, Page 3-17: It may not be possible to collect cored samples to 6 inches below the depth of the original excavation if gravel was used to bridge the water table when the original excavation when backfilling occurred. Many of the open trenches in Parcel G contained groundwater because the water table is relatively shallow, so it is likely that gravel may have been used as backfill in some or all of these trenches. Trenches where gravel was or may have been used to bridge the water table should be identified so that an alternative sampling method (e.g., potholing) can be used. Please identify trenches where gravel was or may have been used to bridge the water table and propose an alternative sampling method to obtain samples from 6 inches below the depth of the original excavation.

The intent of the subsurface sampling is to sample below the backfill material within the original trench surface, but in some cases the original excavation may have progressed to bedrock. It is unlikely that gravel used as bridging material will cause refusal. If direct-push drilling does pose an issue, other drilling methods will be used. Deviations from the work plan will be documented in the report, and the text was revised for clarification.

14. Section 3.6.4.1, Subsurface Soil Sample Collection, Page 3-18: The text indicates that “use of a 3-inch-internal-diameter sampler may be required” in order to obtain sufficient sample volume for analysis, but it is unclear why drilling a second borehole adjacent to the first is not included as a potential method to collect sufficient soil. If the soil is sandy, it may not be retained in a 3-inch sampler, but may be retained in a smaller diameter sampler with a bottom basket. Please propose multiple potential methods for collection of sufficient sample volume.

The first paragraph has been revised to read as follows: “...spoon sampling. When needed, other methods may be considered and applied. Specific sampling methods used will be documented in the field and work plan deviations will be described in the final report. Generally, drilling...”

15. Section 3.6.7.2, Decontamination and Release of Equipment and Tools, Page 3-21: The text discusses possible decontamination of equipment and tools at the completion of fieldwork, but this should not be optional because there could be chemical contamination in addition to radiological contamination. In addition, decontamination of equipment and tools is necessary between sampling locations (e.g., shovels, trowels, mixing bowls, coring equipment). Please revise the Work Plan to provide a more complete decontamination plan and to require decontamination of all equipment and tools before they are removed from the site.

The text was updated to require decontamination between sampling locations and for all equipment and tools before they are removed from the site.

16. Section 5.5, Reference Background Area Soil Data, Page 5-6: The text states that RBA data sets will be compared to each TU/SU data to demonstrate the RBA data set for soil is representative of soil in each TU/SU by comparing the median of the two data sets to determine if there is a statistical difference in the medians. However, the text does not state how it will be determined that the soil sample(s) collected from the TU or SU used for this comparison will represent only background and not site contamination. Further, it is unclear why the Work Plan proposes to compare the medians of data populations between background soil and investigation unit soil rather than to perform the evaluation recommended by the EPA. This evaluation includes analyzing the soil for the primordial naturally occurring parent and daughter radionuclides to determine if they are in secular equilibrium to identify whether the radionuclide ratios indicates the soil represents background. Please revise the Work Plan to require evaluation of secular equilibrium before any statistical comparisons are conducted.

See response to USEPA General Comment 19. In addition, the discussion concerning representativeness of RBA data sets has been removed from Section 5.5.

17. Appendix A, Section 2.0, Purpose and Objectives, Step 2 - Identify the Objective, Page 2-1: The text does not appear to distinguish between potential contamination and background levels. Step 2 states that the background study is being conducted to “establish representative background data sets for soil ROCs, NORM radionuclides, and fallout ROCs for comparison and evaluation of soil data collected from the HPNS.” This statement seems to imply that soil ROCs may be present in background that are not present due to Naturally Occurring Radioactive Material (NORM) or from fallout associated with nuclear tests or reactor accidents. There is a similar statement under Step 3 - Identify Inputs to the Objective. Please revise the text to clarify that only ROCs that are present due to NORM or fallout may be considered background.

The text was revised for clarification.

18. Appendix A, Section 2.0, Purpose and Objectives, Step 4-Define the Study Boundaries, Page 2-1: Step 4 proposes an inconsistent sampling strategy. This section states that in Parcels B, C, D-1, and D-2, reference background surface soil samples will be collected from 0 to 6 inches below ground surface bgs, and subsurface soil samples will be collected from 1- to 2-foot intervals to a depth of up to 10 feet bgs. However, at the off-base location, surface soil samples will be collected from 0 to 6 inches bgs and subsurface samples to a depth of 10 feet bgs are not proposed. It is unclear why samples collected from on-base background locations will be obtained from the subsurface in 1- to 2- foot intervals to a depth of up to 10 feet bgs, but off-site background samples will only be collected from 0 to 6 inches. Collecting subsurface samples from the off-site location will provide valuable information about the depth of deposition and transport of radionuclides from fallout, as well as the potential differing distribution of NORM at depth. In addition, a lithological profile of off-site subsurface soil should be completed to provide additional support to any correlation drawn from soil profiles and NORM collected at the HPNS. Please revise the off-site sampling approach to include collection of subsurface samples.

The text was updated to indicate that 25 surface and 25 subsurface soil samples will be collected from the offsite RBA location. Subsurface soil samples from the offsite RBA will be collected from 1 to 2 feet bgs using hand tools to minimize the impact of the characterization to the offsite RBA.

19. Appendix A, Section 2.0, Purpose and Objectives, Step 5 - Develop Decision Rules and Step 6 - Specify the Performance Criteria, Pages 2-1 and 2-1: The performance criteria discussion states that the background data sets will be evaluated for suitability based on statistical tests, but prior to performing the statistical tests, an evaluation of whether the naturally occurring radionuclides that are also ROCs should be evaluated to determine if the U-238 parent and daughter radionuclides, and as applicable, Th-232 and daughter radionuclides are in secular equilibrium. This is necessary to ensure elevated ROCs that are present due to contamination are not eliminated as outliers. Please revise this discussion to address the need to evaluate whether the U-238 and Th-232 series radionuclides are in secular equilibrium before performing statistical tests to identify outliers or to derive population estimators for comparison to site data.

See response to USEPA General Comment 19. In addition, evaluation of secular equilibrium conditions has been added to the Soil Reference Background Area Work Plan.

20. Appendix A, Section 3.1.6, Field Instrumentation, Gamma Detectors, Page 3-5 and 3-6: The text provides a list of two gamma survey instruments that will be used in the RBA but does not provide the detection limits for each instrument. Please revise Appendix A to include the efficiency and detection limits for the gamma survey instruments and the required instrument sensitivities that meet the data quality objectives for identifying radionuclides at background levels.

Example scan MDC calculations have been added to the Soil Reference Background Area Work Plan for both Cs-137 and Ra-226 in Section 3.1.6.

21. Appendix A, Section 3.1.7, Laboratory Analysis, Pages 3-6 and 3-7: Section 3.1.7 lists the radionuclides that will be analyzed but does not reference the QAPP that contains the QC requirements or detection limits for such analysis. Please revise Appendix A to include this information or reference the QAPP that includes this information.

The SAP provides QA/QC requirements, and a reference was added to the text.

22. Appendix A, Section 3.2.4, Surface Soil Sampling Process, Pages 3-9 and 3-10 and Section 3.2.5.2, Subsurface Soil Sample Collection, Pages 3-11 and 3-12: Please specify the required sampling volume and sample container in Section 3.2.4 and Section 3.2.5.2. Similarly, please specify the type of container that will be used to store soil intervals not designated for sampling (e.g., will core boxes or sealed jars be used?).

The referenced sections provide the required sample amount (a minimum of 200 grams). The sample containers will be provided by the laboratory prior to sample collection.

Clarifying text was added to state that following core processing (i.e., logging, observing, and sampling), excess material that was not sampled will be returned to the borehole it was retrieved from or will be spread directly adjacent to the borehole location.

23. Appendix A, Section 3.2.4, Surface Soil Sampling Process, Pages 3-9 and 3-10 and Section 3.2.5.2, Subsurface Soil Sample Collection, Pages 3-11 and 3-12: Please provide decontamination procedures for drill rig tooling, hand tools, and bowls used for mixing should be specified in the text.

The following text has been added to the bulleted lists: “Decontamination of sampling equipment will be conducted using SOP RP-132, Radiological Protective Clothing Selection, Monitoring, and Decontamination (Appendix C).”

24. Appendix A, Soil Reference Background Area Work Plan, Section 4.2 Analytical Data Evaluation: The Work Plan in Appendix A should be revised to provide a more comprehensive strategy for selecting background values for comparison to site data and use in demonstrating compliance with the ROD RGs. For example, the strategy should consider the following inputs: the population distribution, characteristics (i.e. skewness) and variance for each background reference location or multiple locations; the frequency of detection; and site-specific factors (i.e. soil type, topography, depth, homogeneity or heterogeneity of the data set, or other). In addition, analysis of the background data set should include the appropriate statistical calculations or charts and graphs (such as quantile-quantile [Q-Q] Plots). The Work Plan should also describe how background data sets will be validated and at what frequency and should state that the complete data packages and data validation reports will be made available to the regulators for review prior to the selection of background values. Finally, one or more scoping and decision-making discussions between the regulators and the Navy should be conducted to select the most appropriate background values. Please provide a more comprehensive strategy for selecting background values that includes these issues. In addition, please revise Appendix A to specify that the full data packages, data summary tables, and data validation reports (from third-party data validators) will be given to the regulators for review.

The types of statistical analysis recommended were added. The results and recommendations for background values will be presented in the draft report that will be submitted for regulatory review. The draft background report will include full data packages, data summary tables, and data validation reports (from third-party data validators). Meetings will be held with the regulatory agencies to discuss the results and to facilitate consensus on appropriate background values. The text was updated to reflect this.

25. Appendix A, Section 4.2.2 Identify Outliers, Page 4-2: This section states that background data values will be evaluated to determine if any are outside of the expected distribution using Dixon's and Rosner's statistical outlier tests, both of which assume the data are normally distributed. However, the previous Section 4.1.2, Outliers Test, states, "Because environmental data tend to be right-skewed, a test that relies on an assumption of a normal distribution may identify a relatively large number of mathematical outliers." Section 4.1.2 also states that outliers identified in statistical test will be reviewed to determine whether any suitable reasons (e.g., a potential analytical error) exist to exclude them from further calculations, and confirmed outliers will be removed from individual data sets. Therefore, please revise the Work Plan to specify that all background data sets should be evaluated using non-parametric statistical tests to evaluate population estimators (i.e., such as mean, standard deviation, and others) and potential outliers. Also, please ensure all naturally occurring radionuclides that are also ROCs undergo an evaluation to determine if the U-238 and Th-232 decay chains are in secular equilibrium prior to conducting any outlier evaluations to ensure ROCs that are present due to contamination are not eliminated.

The text has been revised to read as follows: “Graphs of analytical data will be reviewed for indications of data values outside of the expected distribution (i.e., potential outliers). In addition, outlier evaluations will be performed using Dixon’s and Rosner’s tests or other appropriate tests, including non-parametric methods. Dixon’s test is...” In addition, the bulleted list in Section 4.2 has been revised to add the following bullet: “Review equilibrium conditions of naturally-occurring radionuclides”.

26. Appendix A, Section 4.3, Reporting, Page 4-4: This section states that information from other San Francisco Bay Area radiological background studies may be referenced in the BRA report as appropriate. Please also revise the Work Plan to state how the Navy will determine if the other San Francisco background data sets are sufficiently comparable/representative of conditions/soils at the Hunters Point Shipyard.

Clarifying text has been added that describes how to determine whether other offsite background studies are comparable/representative. Specific points of comparison include, but are not limited to, having comparable/similar NORM constituents, analytical methods, lithology, and latitude.

DTSC Comments

General Comments

1. The Work Plan does not reflect the Regulatory Agency Approach. The Regulatory Agency Approach was provided to the Navy on February 6, 2018 during a conference call and again on February 16, 2018 at a meeting with the Navy and Agencies. The Regulatory Agency Approach requires that if a single radiological exceedance of the RG in a trench or building survey unit that was detected during the Phase I of the investigations cannot be shown to be naturally occurring radioactive material (NORM; also referred to as background), it triggers a 100% Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) Class 1 survey of all trench or building survey units in Parcel G. This requirement is based on a statistical review by US EPA to ensure a 95% confidence level that 95% of the survey units sampled are free of radiological exceedances associated with the Navy's past activities that are not NORM/background. DTSC acknowledges, as indicated in the draft Work Plan (Appendix A) that new background soil data will be collected and evaluated as part of this investigation to determine the appropriate background levels.

The Phase II sampling effort of the remainder of the soil survey units will provide additional confidence that the remaining survey units meet the 2009 Record of Decision (ROD) RGs, US EPA risk criteria, as well as meet the sampling requirements of CDPH. As indicated in the February 16, 2018 meeting, the Regulatory Agency Approach provides a scientifically supported alternative approach that will be acceptable to DTSC based on the scope of falsification of data and data quality issues identified at Parcel G. The Work Plan needs to be revised to reflect the Regulatory Agency Approach.

This comment was addressed; see response to USEPA General Comment 2.

2. As mentioned above, the soil investigation is to be conducted in two phases under the Regulatory Agency Approach. Phase 1 requires 33% of the Trench Units (TUs) and 50% of the Building Soil Units (SUs) in Parcel G to be completely excavated and 100% of the soil surveyed. Phase 2 consists of a different survey and sampling effort of the remaining 67% of the TUs and SUs. Phase 2 would only be acceptable if there were no exceedances of the RAO/RGs, with the exception of NORM/background, in Phase 1. CDPH requires surveys and sampling in all TUs and SUs. Without the Navy's full acceptance of Phase I with respect to one failure leading to the requirement for 100% survey/sampling of all SUs or TUs, unless the Navy can demonstrate that the exceedance(s) are related to NORM/background, Phase I is no longer an option and 100% excavation and survey of all TUs and SUs would be required. The Regulatory Agency Approach is a scientifically supported alternative that is acceptable to the Agencies based on the scope of falsification of data and data quality issues at Parcel G. CDPH has indicated that it will not issue a recommendation for radiological unrestricted release to DTSC if the Navy does not fully accept the Regulatory Agency Approach or conducts 100% retesting. The Work Plan needs to be revised accordingly.

This comment was addressed; see response to USEPA General Comment 2.

3. The Work Plan indicates that if data collected are not compliant with certain objectives, then the data will be evaluated for protectiveness based on the US EPA's current guidance on Radiation Risk Assessment. The description of the objectives (Remedial Action Objectives (RAO)) is inconsistent throughout the Work Plan, e.g., the Parcel G RAO, the RAO and background levels, or the RGs. The Work Plan needs to be revised for consistency. DTSC believes that a data point that exceeds an RG does not meet the RAO unless the Navy can demonstrate that the data point is NORM/background.

The work plan was reviewed and updated for consistency. Also, see response to USEPA General Comment 2.

4. The Work Plan states that soil or structures that are not compliant with the RAO will be evaluated for protectiveness based on the US EPA's current guidance on Radiation Risk Assessment. DTSC defers to US EPA to interpret their own guidance and reiterates that the site investigation and remediation must meet the ROD RGs. Therefore, it is DTSC's position that the Work Plan needs to be revised accordingly.

See response to USEPA General Comment 3.

5. If data exceeds RAO/RGs, the Work Plan indicates that further evaluation would be conducted to determine whether Site conditions are protective of human health using US EPA's current guidance on Radiation Risk Assessment. This would not meet CDPH's requirement to obtain levels similar to naturally occurring levels and/or anthropogenic background levels. As stated in the enclosed CDPH memo, "a final status survey report that compares the distribution of data from the building/excavation sites with applicable reference area data and documents the remediation efforts" will be required. Soil concentrations that exceed RGs plus reference area data (background levels) cannot be left in place. If left in place, CDPH has indicated that it cannot issue a recommendation for radiological unrestricted release to DTSC. Therefore, the Work Plan needs to be revised accordingly.

See response to CDPH General Comment 1.

6. The Phase I TUs and SUs selected by the Navy for resampling need to be revised to reflect US EPA's recommendations for TUs and SUs to be resampled.

See response to USEPA General Comment 13.

7. The Work Plan indicates that an additional 6 inches of soil beyond the trench walls will be removed and surveyed instead of conducting surveys of the walls within the trench. This method would not indicate where along the wall soil was obtained in order to investigate further if an exceedance of the RG is identified. The additional 6 inches of soil need to be segregated from the rest of the excavated soil from each trench and, if an exceedance of the RGs is identified that is not determined to be NORM/background, the sidewall or bottom of the trench from which that soil was removed needs to be surveyed. Additionally, soil should not be returned to the excavated area until the trench wall evaluation is completed. Therefore, the Work Plan needs to be revised accordingly.

See response to USEPA General Comment 4.

8. The Regulatory Agency Approach for Phase II required removal of the asphalt over TUs and SUs in order for surface surveys to be conducted in addition to core sampling. The Work Plan does not include these surface surveys. CDPH requires that all TUs and SUs be surveyed. CDPH has indicated that it cannot issue a recommendation for radiological unrestricted release to DTSC if surveys are not conducted at each TU and SU. Therefore, the Work Plan needs to be revised accordingly.

See response to USEPA General Comment 6.

9. Finally, throughout the Work Plan the Navy indicates that there have been various allegations of data manipulation or falsification committed by Tetra Tech EC employees and their subcontractors. In March and May of 2017, two former employees pleaded guilty to admitting falsification of documents in a United States Department of Justice case. In light of this, some allegations have now been proven. Further, and as indicated earlier, in addition to the falsifications of data, the Agencies identified various data quality issues, as well. Therefore, it is recommended that the Work Plan be revised to reflect these, accordingly.

See response to USEPA Specific Comment 2.

CDPH Comments

General Comments

1. Please note that CDPH-EMB utilizes Section 30256 in Title 17 of the California Code of Regulations (17 CCR 30256) to render a decision to concur with a Radiological Unrestricted Release Recommendation (RURR). As a result, CDPH-EMB requires a final status survey report that compares the distribution of data from the building/excavation sites with applicable reference area data and documents the remediation efforts. The final status survey should document and explain reasonable efforts that have been made to remediate the site.

The final status survey results, including a comparison to background and discussion of remedial activities performed as part of the investigation, will be included as an attachment to the RACR.

2. This work plan seems to be drawn up without regard to United States Environmental Protection Agency (USEPA), California Department of Toxic Substance Control (DTSC) and California Department of Public Health (CDPH) proposal. CDPH worked collaboratively with DTSC and USEPA (collectively "Regulators") to develop, Regulators' Approach (<https://semspub.epa.gov/work/09/100009179.pdf>; pg. 36-38). This document establishes the minimum amount of resampling acceptable in order for the Environmental- Management Branch (EMB) of CDPH issue a radiological unrestricted release recommendation (RURR). Please note specifically the requirement that if one trench unit fails (soil concentration exceeds the cleanup goal, which is Remedial Goal [RG] plus reference background, and is not proven to be Naturally Occurring Radiological Material [NORM]), then 100% of Parcel G trench units must be excavated, scanned, and remediated if needed. This same clause applies to building site soil survey units.

See response to USEPA General Comment 2.

3. Please perform the following statistical analyses on the data collected from the Survey Units (SUs) with data collected from the background reference area: box plot, histogram, distribution analysis, normal (log) probability plot, Q-Q plot and comparison to material specific background.

Section 5.2.2 has been revised to include a discussion of box plots and potential distributions consistent with individual data sets including normal, lognormal, and gamma distributions.

4. Equations drawn from source texts, technical references or regulatory guides should include source citations to assist in the review process. Equations which are derived from source texts, technical references or regulatory guides should demonstrate derivation.

Specific equation references have been added.

5. CDPH-EMB is concerned that the re-excavation specified for the Phase 1 Trench Unit Design also represents a soil treatment due to movement and mixing of the potentially elevated trench soil prior to scanning. What steps will be taken to preserve the integrity of the soil sampling process?

Excavation does not constitute treatment of soil. Re-excavation of trenches is necessary to achieve the 100 percent scanning coverage required in the regulators' proposal. The appropriate equipment and sampling approach was selected to identify contamination, if it is within the excavated soil. An in situ scan of the sidewalls and bottom of the excavation will be conducted if contamination is identified. Also see responses to USEPA General Comment 4 and USEPA Specific Comments 11 and 12 regarding the soil sorting approach and the Navy's efforts to avoid mixing of potentially contaminated soil.

Specific Comments

6. Section 1, introduction page 1-1, paragraph one, sentence three, "The radiological characterization will be conducted in accordance with the general approach and methodologies that are provided in the Draft Parcel G Removal Site Evaluation Work Plan (Parcel G Work Plan) (Navy, 2018), a separate Sampling and Analysis Plan (SAP), and a separate Accident Prevention Plan/Site Safety and Health Plan (APP/SSHP)." Please provide the above cited documents for CDPH-EMB review prior to onset of survey activities. CDPH-EMB will not consider its comments closed until these documents are provided.

The draft SAP was submitted for review on August 16, 2018. The APP/SSHP is an internal Navy document to comply with NAVFAC safety standards, and it will be provided for reference.

7. Executive Summary, Project Purpose, page iii. paragraph two, sentence one, "Portions of soil or structures that are not compliant with the RAO will be evaluated for protectiveness based on the United States Environmental Protection Agency's (USEPA 's) current guidance on Radiation Risk Assessment at CERCLA Sites (USEPA, 2014)". As noted above, CDPH-EMB requires a final status survey report that compares the distribution of data from the building/excavation sites with applicable reference area data in order to concur to issue a RURR; please include a statistical comparison to applicable reference area data as a part of the project purpose.

A statistical comparison of site data to applicable reference area data was added to the project purpose.

8. Executive Summary, Scope, page iiL paragraph one, sentence one, "The radiological investigation will be conducted at the following sites:

- Former Sanitary Sewer and Storm Drain Trenches
- Buildings 317/364/365 Former Building Site
- Building 351A
- Building 351
- Building 366
- Building 401
- Former Building 408 Concrete Pad
- Building 411
- Building 439

According to Regulators' Approach (<https://semspub.epa.gov/work/09/100009179.pdf>; pg. 36-38) a certain criteria has been established for the selection of priority survey units. Please refer to the United States Environmental Protection Agency (USEPA) Review of the Draft Parcel G Removal Site Evaluation Work Plan, Hunters Point Naval Shipyard, San Francisco, California, June 18, 2018, USEPA Review dated August 14, 2018; comments for specific areas to be surveyed.

The regulators' approach has been incorporated into the work plan and corresponding changes to the text have been added to the applicable sections.

9. Executive Summary, Conceptual Site Model. pages iii and iv. The section does not describe how the conceptual site model has changed due to previous remediation work. For example, based on the Historical Radiological Assessment, sewer and storm drain pipes were present and thought to be the source of contamination in trench units with the soil above the pipes being mostly not impacted. Currently, the pipes have been removed but the backfill soil may be contaminated or its status is unknown due to alleged activities.

Because the level of detail needed for a comprehensive CSM is not relevant to an Executive Summary, the referenced text was removed from the Executive Summary. A comprehensive CSM is provided in Section 2, which contains the information in the comment.

10. Executive Summary, Soil Investigations, page iv, paragraph one, sentence one, "Soil investigations will be conducted at the following areas:

- Former Sanitary Sewer and Storm Drain Trenches
- Buildings 317/364/365 Former Building Site
- Building 351A Crawl Space

Please refer to the United States Environmental Protection Agency (USEPA) Review of the Draft Parcel G Removal Site Evaluation Work Plan, Hunters Point Naval Shipyard, San Francisco, California, June 18, 2018, USEPA Review dated August 14, 2018; comments for specific areas to be surveyed.

The regulators' approach has been incorporated into the work plan and corresponding changes to the text have been added to the applicable sections.

11. Phase 1 Investigation, page iv, paragraph one, sentence one, "Phase 1 includes the radiological investigation on a targeted group of TUs and SUs. Twenty-one of the 63 former sanitary sewer and storm drain TUs were selected for the Phase 1 investigation. Fourteen of the 28 surface soil SUs from the Buildings 317/364/365 Former Building Site and Building 361A Crawl Space were selected for the Phase 1 investigation." Please refer to the United States Environmental Protection Agency (USEPA) Review of the Draft Parcel G Removal Site Evaluation Work Plan, Hunters Point naval Shipyard, San Francisco, California, June 18, 2018, USEPA Review dated August 14, 2018; comments for specific areas to be surveyed.

The regulators' approach has been incorporated into the work plan and corresponding changes to the text have been added to the applicable sections.

12. Phase 1 Investigation, page v, paragraph one, sentence one, "Soil may be laid out on Radiological Screening Yard pads for a surface scan, or soil may be processed and scanned using soil segregation technology." Please be advised that CDPH-EMB has not yet been provided the information necessary to come to a decision on the use of soil segregation technology at HPNS.

Comment noted. See response to USEPA Specific Comment 12.

13. Phase 1 Investigation, page v, paragraph one, sentence two, "Following excavation to the original TU boundaries, additional excavation of approximately 6 inches of the trench sidewalls and floors will be performed to provide ex situ scanning and sampling of the trench sidewalls and floors." Please ensure that the over-excavation soils are sampled separately and stored separately from soils removed from the original TU. Please ensure the excavated soils are traceable back to their TU origin. If a radiological exceedance is found; CDPH-EMB requires a follow up Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) Class I survey be performed on the TU of the soil's origin.

As stated in Section 3.4.4, "The over-excavated material representing trench sidewalls and floors will be maintained as separate volumes (e.g., piles) of soil from the original excavated soil."

Text in the Executive Summary and throughout the work plan has been updated to describe an in situ investigation of the open excavation if an exceedance in sidewall or floor material is found.

Additional text has been added to Section 3.6 of the work plan to require additional excavation location tracking information for sidewall and floor material, including the former TU name and which sidewall or floor surface the material was excavated from.

14. Phase 1 Investigation, page v, paragraph three, sentence one, "Systematic and bias samples will be collected from the excavated soil from the TUs, within the surrounding soil of the TUs, and from the surface soil SUs." Please ensure that the over-excavation soils are sampled separately and stored separately from soils removed from the original TU. Please ensure the excavated soils are traceable back to their TU of origin. If a radiological exceedance is found; CDPH-EMB requires a follow up MARSSIM Class I survey be performed on TU of the soil's origin.

See response to CDPH Specific Comment 13.

15. Building Investigations, page v, paragraph one, sentence one, "Investigations of interior surfaces will be performed for the following buildings:

- Building 351A
- Building 351
- Building 366
- Building 401
- Former Building 408 Concrete Pad
- Building 411
- Building 439

Please refer to the United States Environmental Protection Agency (USEPA) Review of the Draft Parcel G Removal Site Evaluation Work Plan, Hunters Point Naval Shipyard, San Francisco, California, June 18, 2018, USEPA Review dated August 14, 2018; comments for specific areas to be surveyed.

The regulators' approach has been incorporated into the work plan and corresponding changes to the text have been added to the applicable sections.

16. Data Evaluation and Reporting, page vi, paragraph two, bullet two, sentences one and two: "Individual samples reporting 226Ra gamma spectroscopy concentrations greater than the RG for 226Ra will be analyzed for uranium-238 (238U) and 226Ra using comparable analytical methods. For that specific sample, the 238U result will be used as a more representative estimate of the background value for 226Ra, and the alpha spectrometry 226Ra concentration will be compared to the RG for 226Ra using the revised background value." Please specify that the process outlined above is to establish that Ra-226 levels are within the naturally occurring radioactive material (NORM) range. Please refer reader to Section 5.4 for a fuller discussion of NORM Background Investigation.

The Executive Summary has been revised, and a reference to Section 5 was added.

17. Table ES-1. Soil and Building Trench and Survey Units: Figure ES-1. Soil and Building Sites. Please refer to the United States Environmental Protection Agency (USEPA) Review of the Draft Parcel G Removal Site Evaluation Work Plan, Hunters Point naval Shipyard, San Francisco, California, June 18, 2018, USEPA Review dated August 14, 2018; comments for specific areas to be surveyed.

The regulators' approach has been incorporated into the work plan and corresponding changes to the text have been added to the applicable sections.

18. Section 3.1 Data Quality Objectives, page 3-1, bullet five-Develop Decision Rules, paragraph one, sentence two, "The RACR will describe the results of the investigation and will provide a demonstration that radioactivity levels meet the Parcel G RAO or represent background conditions." Please see comment #1.

See response to CDPH General Comment 1.

19. Section 3.1 Data Quality Objectives, page 3-1, bullet five-Develop Decision Rules. paragraph two, sentence one, "If the investigation results demonstrate that site conditions are not compliant with the Parcel G RAO and exceed background levels, then the data will be evaluated to determine whether site conditions are protective of human health using USEPA's current guidance on Radiation Risk Assessment at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sites (USEPA, 2014). "As noted above, CDPH-EMB requires a final status survey report that compares the distribution of data from the building/excavation sites with applicable reference area data in order to concur to issue a RURR; this is irrespective of USEPA's current guidance on Radiation Risk Assessment at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sites (USEPA, 2014).

See response to CDPH General Comment 1.

20. Section 3.1 Data Quality Objectives, page 3-2, bullet one, sentences one and two: "Individual samples reporting 226Ra gamma spectroscopy concentrations greater than the RG for 226Ra will be analyzed for uranium-238 (238U) and 226Ra using comparable analytical methods. For that specific sample, the 238U result will be used as a more representative estimate of the background value for 226Ra, and the alpha spectrometry 226Ra concentration will be compared to the RG for 226Ra using the revised background value". Please see comment number 16.

See response to CDPH Specific Comment 16.

21. Section 3.3.1 Investigation Levels, page 3-3, paragraph three, sentence four. "The spectra will be evaluated using regions of interest peak identification tools for the ROCs that correspond to gamma rays at 186 kiloelectron volt (ke V) for 226Ra, 609 ke V (226Ra daughter bismuth-214 [214Bi]), and 662 keV for 137Cs." EMB notes that using gamma rays at 186 kiloelectron volt (keV) for 226Ra is a quicker, less accurate method of analyzing for 226Ra and is known to be biased high. This bias is noted in the discussion of the conceptual site model, page IV, paragraph one, bullet one, sentence two, "A large amount of soil (estimated 80 percent) was likely mischaracterized as contaminated (Argonne National Laboratory, 2011)." Also, for short scan counts it is doubtful that enough counts will be obtained in the selected peak region to provide adequate counting statistics to identify soils at the Ra-226 investigation level. Please explain the use of 186 kiloelectron volt (keV) as the identifying peak for 226Ra.

Scanning measurements collected with gamma spectroscopy (such as with the RS-700) will be evaluated using multiple regions of interest to determine the presence of Ra-226. The 186 keV energy peak will be one of several gamma energies associated with Ra-226 that will be evaluated. Section 3.5 of the work plan has been revised to include the data evaluation approach for scan data collected with the RS-700.

22. Section 3.4 Radiological Investigation Design, page 3-4, paragraph three, sentences two and three: "Phase 1 includes the radiological investigation of 21 previously established TUs and Phase 2 includes the remaining 42 TUs in Parcel G. Similarly, for surface soil areas associated with soil from building sites, Phase 1 includes the radiological investigation of 14 of the 28 SUs and Phase 2 includes the remaining 14 SUs in Parcel G."

Please refer to the United States Environmental Protection Agency (US EPA) Review of the Draft Parcel G Removal Site Evaluation Work Plan, Hunters Point naval Shipyard, San Francisco, California, June 18, 2018, USEPA Review dated August 14, 2018; comments for specific areas to be surveyed.

The text in Section 3.4 has been updated to reflect the regulators' approach. For the building site SUs, because 100 percent surface scans were added for all TUs and SUs, the building site SUs will all be investigated consistently and concurrently, and there are no longer phases for surface soil SUs.

23. Section 3.4.1, Number of Samples, page 3-4, paragraph one, sentence one, "Following the previously established protocol (TtEC, 2012), a minimum of 18 systematically located samples will be collected from each TU or SU."

- a. Please provide the calculations which will determine the number of soil samples to be collected reflective of new reliable data.

See response to USEPA General Comment 5.

- b. Does this mean that for soils surveyed on a radiological survey yard (RSY) pad, a minimum of 18 (or otherwise determined number of samples) systematically located samples will be collected from each six inch lift of soil from TU or SU?

Correct.

- c. What trigger value will cause biased samples be collected and analyzed?

Section 3.4.6 states "Biased samples will be collected from potential areas of elevated activity displaying gamma scan survey results greater than the investigation level."

24. Section 3.4.4 Phase 1 Trench Unit Design, page 3-5, paragraph two, sentence two, "The excavated soil material will be investigated by gamma scan surveys and systematic and bias soil sample collection following either the automated soil sorting system process (Section 3.6.3.1) or the RSY process (Section 3.6.3.2)." Please see comment number 12.

See response to CDPH Specific Comment 12.

25. Section 3.4.5 Phase 2 Trench Unit Design, page 3-7, paragraph two, sentence one, "Within the backfill of each previous TU boundary, six systematic locations will be cored down to approximately 6 inches below the depth of previous excavation."

- a. According to Regulators' Approach (<https://semspub.epa.gov/work/09/100009179.pdf>; pg. 36-38) the number of core samples required within the trench will be determined based on new reliable data and statistical analysis.

See response to USEPA General Comment 5.

- b. EMB asserts that the term, "core samples", refers to the entire soil column (plug) removed as a result of direct push technology. From this column of soil any number of individual soil samples may be obtained. For example: if the value, "N", is calculated from new reliable data such that the resulting value of, "N", is 20; then 20 core sample soil columns (plugs) must be obtained. In this example, if 3 soil samples were obtained from each core sample soil column (plug); then the resulting number of soil samples to be collected is 60.

Text and figures throughout the work plan have been modified to reflect the requirement to have "N" (equal to the number of samples required in a unit) boreholes within the boundary of each Phase 2 TU.

26. Section 3.4.6 Phase 1 Survey Unit Design, page 3-7, paragraph one, sentence one, "Radiological investigations will be conducted on a targeted group of 14 of the 28 SUs associated with soil from building sites where only surface soil scanning and sampling was previously conducted (Figure 3-1). "Please refer to the United States Environmental Protection Agency (US EPA) Review of the Draft Parcel G Removal Site Evaluation Work Plan, Hunters Point naval Shipyard, San Francisco, California, June 18, 2018, USEPA Review dated August 14, 2018; comments for specific areas to be surveyed.

See response to CDPH Specific Comment 22.

27. Section 3.4.6 Phase 1 Survey Unit Design, page 3-7. paragraph two. Sentence four, "Gross gamma and gamma spectra obtained during the surface gamma scan surveys will be analyzed using region of interest peak identification tools for the ROCs." Please see comment number 21.

See response to CDPH Specific Comment 21.

28. Section 3.4. 7 Phase 2 Survey Unit Design. page 3-8. paragraph one. sentence one, "Phase 2 soil area SUs will be characterized by collecting systematic surface soil samples." Please include a 100% Gamma Walkover Survey (GWS) for phase 2 surface soil areas.

See response to CDPH Specific Comment 22. In addition, the work plan has been updated to include the 100 percent surface scan of all TUs and SUs.

29. Section 3.5.1 Soil Gamma Scanning Instruments, page 3-8, paragraph one, sentence four, "The spectra will be evaluated using regions of interest peak identification tools for the ROCs that correspond to gamma rays at 186 ke V for 226Ra, 609 keV (226Ra daughter 214Bi), and 662 keV for 137Cs." Please see comment number 21.

See response to CDPH Specific Comment 21.

30. Section 3.5.2.2 Gamma Scan Minimum Detectable Concentration, page 3-9, paragraph one. sentence one, "Field instrument use will be evaluated and controlled to verify that MDCs less than the appropriate limit for scanning measurements are routinely achieved". This apparently contradicts Section 3.3.1 Investigation Levels, page 3-3, Table 3-6, Soil Survey Measurement Investigation Levels, Investigation Level (pCi/g), footnote, "a", "Gamma scan surveys will not detect 137Cs at 0.113 pCi/g." Please explain how MDCs less than the appropriate limit for scanning measurements are routinely achieved.

See response to USEPA General Comment 10.

31. Section 3.5.2.2 Gamma Scan Minimum Detectable Concentration, Equation 3-1. CDPH-EMB believes this equation to be incorrectly stated. Table 6.4, NRC, 1998 applies to static one minute counts specific to U-238. The equation does not include both the weighted instrument and surface efficiencies in its calculation. Please review; and if necessary, correct.

The discussion has been revised to reflect updated gamma scan MDC calculations, and the reference to Table 6-4 has been removed.

32. Section 3.6.3 Phase 1 Trench Unit Investigation, page 3-13, paragraph two, sentence three, "One hundred percent of the Phase 1 ESU soils will undergo scan surveys using real-time gamma spectroscopy equipment in the soil sorting process or the RSY pad process." See comments numbers ten and 17.

See responses to CDPH Specific Comments 10 and 17.

33. Section 3.6.3 Phase 1 Trench Unit Investigation, page 3-13, paragraph three, sentence four, "Following completion of scanning activities, the ESU and SFU material will be returned to the same trench that the material originated from." What procedure will be followed if elevated radiological readings exceed the RGs or are not comparable to reference areas? Please explain.

Text in the Executive Summary and throughout the work plan has been updated to describe an in situ investigation of the open excavation if an exceedance not attributable to background in an SFU is found, and an in situ investigation and/or remediation will be performed prior to backfill.

34. Section 3.6.3.1 Automated Soil Sorting System Process, page 3-14. Please see comment number 12.

See response to USEPA Specific Comment 12.

35. Section 3.6.3.1 Automated Soil Sorting System Process, page 3-15, Soil Sampling, paragraph two, sentence one, "One bias soil sample will be collected from the soil material that has been discharged to the "Diverted Pile" bin." A soil survey aimed at representative sampling of diverted soil shall be performed on all soils discharged to the diverted soils bin and the design of that survey should be provided in the work plan. What other actions will be taken when soil is diverted to document the TU and areas from which the soil originated?

See response to CDPH General Comment 5.

36. Section 3.6.3.2 Radiological Screening Yard Pad Process, page 3-16, Investigation, paragraph one, sentence one, "A minimum of 18 systematic soil samples will be collected along with any bias samples based on the results of the gamma scan surveys." Please see comment number 23 (a).

See response to CDPH Specific Comment 23a.

37. Section 3.6.3.2 Radiological Screening Yard Pad Process, page 3-16, Investigation, paragraph two, sentence two, "The Bicorn 3x5x16 Na/ detector coupled to a multi-channel analyzer (or equivalent system) will be equipped with spectral capabilities to provide isotopic identification and quantification in addition to gross gamma readings." At what threshold point will elevated gross gamma readings initiate additional investigation? Please explain.

See response to USEPA General Comment 11.

38. Section 3.6.3.2 Radiological Screening Yard Pad Process, page 3-17, Investigation, paragraph three, sentence one, "Datasets will be transferred from the data logger onto a personal computer to create spreadsheets and geographic information system-plotted maps." Please provide the contour information (contour method, dot size and appropriate defaults) as contour mapping can smooth over discrete elevated locations.

The referenced section describes posting plots rather than contour maps. A statement has been added to Section 5 requiring the Parcel G contractor to provide information on the contour method, dot size, and appropriate information on default values used if contour plots are included in the report.

39. Section 3.6.3.2 Radiological Screening Yard Pad Process, page 3-17, Investigation, paragraph three, sentence five, "Bias samples will be collected from potential areas of elevated activity displaying gamma scan survey results greater than the investigation level (Section 5.3.1)." Since the gamma scan instrumentation being employed cannot detect the RG 0.113 pCi/g value for Cs- 137; does this mean that every identification of Cs-137 will necessitate a bias sample? Please explain. Will gross gamma concentrations trigger further investigation? Please explain.

Biased samples will be collected to investigate scan measurements that exceed investigation criteria within the regions of interest or in the gross count rate window. The gamma scanning system will detect Cs-137 photons; however, individual measurements are not intended to characterize Cs-137 at or below the RG. Therefore, biased soil sample collection will not be based on Cs-137; however, the soil samples will be analyzed for Cs-137. The text was updated for clarification.

40. Section 3.6.4 Phase 2 Trench Unit Investigation, page 3-17, paragraph one, sentence one, "Investigations of the Phase 2 TUs will consist of a combination of core scan surveys and soil samples". The Regulatory Agency Approach for Parcel G- March 23, 2018; offers relief from having to excavate 67% (43) trench units. However; the proposal is conditional in the sense that DON must fulfill the survey requirements outlined in the proposal. Please explain why only surface scans above cores are proposed for the Phase 2 TU investigation instead of 100% surface scans; and how this meets the requirements of Regulators' approach.

Text in the Executive Summary and throughout the work plan has been updated to include the 100 percent surface scan of all TUs.

41. Section 3.6.4 Phase 2 Trench Unit Investigation, page 3-18, paragraph two, sentences one and two: "An additional set of 18 systematic samples will be collected from 6 systematic locations representative of the trench sidewalls. The six core locations will be located within 1 meter of the previous sidewall excavation limits and Will extend to the maximum previous excavation depth." According to Regulators' Approach

(<https://semspub.epa.gov/work/09/100009179.pdf>; pg. 36-38) the number of core samples required within the trench will be determined based on new reliable data and statistical analysis.

- a. Please see comment number 23 (a),
- b. Please note core sample locations are required every 50 linear feet, for trenches greater than 150 linear feet; how will 6 core sampling locations meet this sampling requirement?

See response to CDPH Specific Comment 23a. The sampling approach of the Phase 2 TU sidewall sampling has been modified to reflect the requirement to place a borehole every 50 linear feet, and the text and figures have been updated.

42. Section 3.6.5 Phase 1 Survey Unit Investigation, page 3-19. Please amend this section title so that it is clear that the section refers to building site soil units.

The section was retitled Former Building Site and Crawl Space Soil Survey Unit Investigation.

43. Section 3.6.5 Phase 1 Survey Unit Investigation, page 3-19, paragraph four, sentence one, "Datasets will be transferred from the data logger onto a personal computer to create spreadsheets and, if feasible, gamma scan survey results will be mapped." Please see comment number 38.

See response to CDPH Specific Comment 38.

44. Section 3.6.5 Phase 1 Survey Unit Investigation, page 3-19. paragraph four, sentence two, "Data obtained during the surface gamma scan surveys, including gross gamma, and individual radionuclide spectral measurements, will be analyzed to identify areas where surface radiation levels appear to be greater than the radionuclide-specific investigation levels using regions of interest-peak identification tools." Please ensure that gross gamma scan data; which is not the same as interest-peak identification, is analyzed to identify areas of elevated gamma activity, flagged for field verification and noted on a survey map.

See response to USEPA General Comment 11.

45. Section 3.6.5.1 Surface Soil Sample Collection, page 3-21. Please retain all soil samples for CDPH-EMB confirmatory analysis.

The text was updated to state that soil samples will be retained, for possible CDPH-EMB confirmatory analysis, until the contractor for Parcel G soil work demobilizes from the site.

46. Section 3.6.7 Phase 2 Survey Unit Investigation, page 3-20. Please amend this section title so that it is clear that the section refers to building site soil units.

For the building site SUs, because 100 percent surface scans were added for all TUs and SUs, the building site SUs will all be investigated consistently and concurrently, there are no longer phases for surface soil SUs, and the former Section 3.6.7 was removed.

47. Section 3.7 Radiological Laboratory Analysis. page 3-21. Please include as appendices the laboratory procedures for analyzing the ROCS.

The laboratory procedures are included in the draft SAP that was submitted for review on August 16, 2018.

48. Section 3.7 Radiological Laboratory Analysis. page 3-21, paragraph two, sentence one. "Analysis will be based on the site-specific ROCs listed in Table 3- 4, and in accordance with the SAP. The soil samples will be assayed using gamma spectroscopy analysis for ¹³⁷Cs and ²²⁶Ra with at least 10 percent of samples receiving gas flow proportional analysis for ⁹⁰Sr." How will the 10 percent of soil samples to be examined for ⁹⁰Sr be selected? Please explain.

The Sr-90 analyses for the systematic soil samples will be randomly selected for 10 percent of the samples from a survey unit. The text has been updated for clarification.

49. Section 3.7 Radiological Laboratory Analysis. page 3-21. paragraph two, sentence four. "Additionally, if the laboratory results indicate concentrations of ¹³⁷Cs above its RG, the sample will be analyzed for ⁹⁰Sr. If the laboratory results indicated the presence of concentrations of ¹³⁷Cs or ⁹⁰Sr at or above the RG, additional analysis via alpha spectrometry for ²³⁹Pu will be performed." Please perform alpha spectrometry for ten percent of soil samples for ²³⁹Pu in addition to those samples whose concentrations of ¹³⁷Cs or ⁹⁰Sr are at or above the RG.

Pu-238 is only an ROC at the Former Buildings 317/364/365 Site; therefore, analysis for Pu-239 will be performed for 10 percent of systematic soil samples associated with the former Buildings 317/364/365 Site. The 10 percent will be selected at random. Additional Pu-239 analyses will be performed on samples with Cs-137 or Sr-90 results at or above the RG. The text has been updated for clarification.

50. Section 4.1 Data Quality Objectives, page 4-1. bullet 4, sentence one, Step 4- Define the Study Boundaries: "The study boundaries are accessible interior surfaces of Buildings 351, 351A, 366, 401, 411, and 439, and the concrete pad at former Building 408 (Figure 4-1)." Please refer to the United States Environmental Protection Agency (USEPA) Review of the Draft Parcel G Removal Site Evaluation Work Plan, Hunters Point naval Shipyard, San Francisco, California, June 18, 2018, USEPA Review dated August 14, 2018; comments for specific areas to be surveyed.

The text in Section 4.1 has been updated to reflect the regulators' approach.

51. Section 4.4.1 Number of Static Measurements, page 4-3, paragraph one, sentence two, "Following the previously established protocols (TtEC, 2012), a minimum of 18 measurements will be performed in each SU and on each RBA surface type." Please see comment number 23 (a).

See response to USEPA General Comment 5.

52. Section 4.4.2 Radiological Background, page 4-3, paragraph one, sentence three. "At least 18 static measurements will be taken on each surface material in the RBA that is representative of the material in the building SUs". Please provide the calculations which will determine the number of surface material samples to be collected reflective of new reliable data. Please see comment number 23 (a).

See response to USEPA General Comment 5.

53. Section 4.4.3 Survey Units, page 4-3, paragraph one, sentence one, "Parcel G buildings will be divided into identifiable SUs similar in area and nomenclature to the previous final status survey of each building." If the proposed Parcel G SUs design deviate from the previous Parcel G building SUs in area, nomenclature or material, please explain the reason for the deviation.

The building survey unit boundaries and designations used in the previous surveys will be used for this investigation. Any building-specific variations have been indicated in Section 4, such as the reduction in Class 2 survey unit area sizes attributable to the removal of wall surfaces during recent lead and asbestos abatement activities.

54. Section 4.4.3 Survey Units, page 4-3, paragraph one, sentence three, "The remaining upper wall surfaces and ceilings will form the remaining survey units of no more than 2,000 m² each".

- a. Please state clearly if the remaining 2,000 m² upper wall surfaces and ceilings will form either Class I or Class II MARSSIM SUs.

Remaining walls above 2 meters from the floor and remaining ceilings will be combined into Class 2 survey units, and will not exceed 1,000 square meters in area. Section 4 has been revised to expand the discussion of the survey unit designation and classification.

- b. For all Building Floor Plan Figures; Figure 4-2 through and including Figure 4- 8, please include the remaining 2,000 m2 SUs in the figures.
These figures have been updated to include the remaining SUs.
- c. Please include the remaining 2,000 m2 SUs as a part of Figure 4-10, "Example Building Survey Unit and Sample Locations".
A figure has been added to provide an example of Class 2 boundaries and measurement locations.
- d. For those buildings which are not surveyed in their entirety; please explain why only a portion of the building was subject to a MARSSIM survey.
See response to USEPA General Comment 18b.
- e. Please provide a Class II MARSSIM buffer survey around where Class I MARSSIM surveys performed.
See response to USEPA General Comment 15c.
- f. Please clarify if task specific plan or a work plan will be prepared for each individual building.
Building-specific TSPs or separate work plans are not planned because this work plan contains the information typically provided in TSPs. In addition, the methodology outlined in this work plan is applicable to all remaining impacted buildings in Parcel G.
55. Section 4.5.4 Instrument Efficiencies, page 4-4, Table 4-3. Survey Instrument Efficiencies and Background Count Rates from Manufacturers. Please include manufacture's name in table.
Manufacturers' names have been included for each model referenced.
56. Section 4.5.4 Instrument Efficiencies, page 4-4, Table 4-3. Survey Instrument Efficiencies and Background Count Rates from Manufacturers, Parameter. Alpha total efficiency (4π) for 235U, Model 3030, "0.39". EMB staff is unable to find this U-235 value on manufacture's website or in their product manual. Please describe origin of this value.
The value of 39 percent is the 4-pi efficiency for U-238 reported at <https://ludlums.com/products/all-products/product/model-3030>. The maximum alpha energy for U-235 is nearer to the maximum alpha energy for U-238 than for other reported radionuclides.
57. Section 4.5.7.3 Probability of Alpha Detection for High-background Detectors, page 4-7, Equation 4-2. This equation appears to have elements of two MARSSIM Appendix J equations; for P (n21) and for P (n22) comingled. Please review and correct if necessary.
The derivation has been revised to show all steps, and it references MARSSIM equations as applicable.
58. Section 4.5. 7.4 Beta Scan Minimum Detectable Concentration, page 4-8, Equation 4-4. Please examine this term and correct if necessary.
This equation is correct, with the assumption that the time the detector is over a given area (i) is also the detector dwell time (t). The derivation has been revised to show all steps, and it references MARSSIM equations as applicable.
59. Section 4.5.7.4 Beta Scan Minimum Detectable Concentration, page 4-9, Table 4-6. Beta Scan Minimum Detectable Concentrations. Please examine these results and correct if necessary.
Beta Scan MDCs in Table 4-6 have been reviewed and updated as necessary.
60. Section 5, Data Evaluation and Reporting. Please add, where applicable, specifications for data evaluation such as those specified in comment number three.
See response to CDPH General Comment 3.
61. Section 5.3.1 Identify Potential Areas of Elevated Activity, page 5-4, paragraph one, sentence six, "In addition, SU areas with multiple lines of evidence indicating a potential increase in localized activity based on posting plots, histograms, and Q-Q plots of scan, static measurement, or sample data will be investigated as a potential area of elevated activity." Please quantify what is meant by the phrase, " ... of evidence indicating a potential increase"; i.e., what level of increase will trigger additional investigation. Also please include normal (log) probability plot.
Interpretation of graphical representations of data are subjective and may differ between reviewers. Copies of graphs used to present survey data will be included in all reports so that these subjective interpretations can be reviewed. Conclusions will be drawn based on lines of evidence and will be made on a case-by-case basis, so a single trigger based on the graphical review cannot be established. Also, as stated in Section 5.2.2, a normal probability plot is another name for a Q-Q plot.
62. Section 5.3.2 Investigate Potential Areas of Elevated Activity, page 5-5, paragraph one, sentence five, "Determining the extent of elevated activity for ROCs without a significant gamma emission, such as 90Sr and 239Pu, will require collecting additional soil samples or establishing a correlation between the difficult-to-detect ROC and 226Ra." Please see comment number 49.
See response to CDPH Specific Comment 49.
63. Section 5.3.2 Investigate Potential Areas of Elevated Activity. page 5-5, paragraph three, sentence four, "If the revised 226Ra result exceeds background by more than 1.0 pCi/g, additional evaluation may be performed." Please delete indicated phrase and replace with, "and not shown to be NORM or anthropogenic background; then sample demonstrates non-compliance with Parcel G ROD RAO and is deemed a failure."
Section 5 has been revised to clarify the NORM evaluation process. See response to USEPA General Comment 2.
64. Section 5.5 Reference Background Area Soil, page 5-6, Equation 5-1. Equations drawn from source texts, technical references or regulatory guides should include source citations to assist in the review process
Equation 5-1 has been removed, along with the discussion on determining representativeness of RBA data sets.
65. Appendix A: Section 3.1.3 Reference Background Area Locations, page 3-2, paragraph one, sentence four, "In order to simplify the sampling design, an approximately 20-foot by 20-foot square has been established within each of the four historical RBA footprints."
a. This area is too small to be completely representative of reference background area. Please resize and provide an explanation of the size provided.
b. Please provide unique nomenclature for the, "footprints", as it is confusing to the reader if the text is referring to the larger RBA or the smaller internal footprint.
The onsite areas included in the RBA surface and subsurface sampling have been expanded to areas of approximately 2,500 square feet. The text and figures have been revised accordingly.
66. Appendix A: Section 3.1.4 Number of Samples, page 3-3, paragraph one, sentence two, 'The NRC criteria for providing characterization of a complex site, found iii United States Nuclear Regulatory Commission Regulation (NUREG) 1505 (NRC, 1998) is at least 100 samples from at least 5 distinct locations.' This appears to be a reference to Table 13.5 Power of the F-test When $w^2 = \sigma^2$. Data drawn from source texts, technical references or regulatory guides should include source citations to assist in the review process. The text notes that Table 13.5 is a step in the application of

Scenario B, which in turn requires the application of the Quantile test to, " ... detect non-uniform concentrations of residual radioactivity that may be excess of the release criteria, but might be missed by the WRS test." Will the Quantile test be applied to the soil sample results drawn from Parcel G SUs and TUs?

See response to USEPA General Comment 12d.

67. Appendix A: Section 3.1.4 Number of Samples, page 3-3, paragraph one, sentence six, "Five surface soil samples will be collected from RBAs 1 through 4, for a total of 25 onsite surface soil samples." Please check the multiplication in this sentence and in bullet number four. In order to make a valid comparison between survey units (TUs or SUs) and their relevant reference background areas (RBAs); CDPH-EMB requires that the RBAs have a technically defensible number of systematically located soil samples. If it is the intent to have four separate RBAs established to represent four different kinds of SU or TU conditions, please explain how five surface soil samples from the selected RBA could be used to make a valid statistical comparison to the 18 or more samples drawn from the SU or TU.

The text was updated to indicate that 25 surface and 25 subsurface soil samples will be collected from each RBA location.

68. Appendix A: Section 3.2.3, Scan Measurements, page 3-9, paragraph three, sentence two, "An instrument-specific SOP will be provided to the Navy prior to initiation of field activities." Please provide a copy to the regulatory agencies for review at the same time.

The instrument-specifics were added to the work plan.

69. Appendix B: Draft Radiation Protection Work Plan Radiological Data Evaluation and Confirmation Survey: Section 2.6, Radiological Control Technicians. page 6, paragraph one, sentences two and three: All RCT's shall be qualified as senior RCT's (<= 5 years as a qualified and documented RCT, either U.S. Department of Energy core, North East Utility Exam, National Registry of Radiation Protection Technologists [NRRPT], etc.). On a case by case basis, Jr RCrs will be evaluated by CH2M.

- a. Is the intent of sentence two to require 5 or more years' experience to qualify as a Senior RCT? Please explain.

Yes, a minimum of 5 years' experience is required to qualify as a Senior RCT.

- b. Will work performed by Jr RCT's be countersigned by a Senior RCT? Will a promotion from Jr. RCT to Senior RCT on the project call for the same experience and training requirements to be met as technicians originally hired as Senior RCTs?

Yes, work by a Junior RCT will be countersigned by a Senior RCT, and the requirements for promotion to a Senior RCT title are the same as the new hire requirements.

SFDPH Comments

General Comments

1. It is hard to track the slightly scattered details in the plan regarding the radionuclides of concern (ROCs) and corresponding RGs that are applicable to individual areas and survey types. A number of specific comments regarding these possible inconsistencies have been included. Similarly, the plan also seems inconsistent regarding whether all samples will be analyzed for all ROCs or just subsets of samples for certain ROCs. It might help the reader to provide some clarification in summary tables?

Refer to Tables 3-4 and 4-1 for descriptions of the ROCs for each area or building in Parcel G. The discussion in Section 3.7 was updated to provide additional details on the radionuclide analyses that will be performed.

2. In our professional judgement, the use U-238 as a proxy for Ra-226 may cause problems in your evaluation. We have found that this equilibrium is not consistent between U-238 and Ra-226 in real-world environmental samples. Additional detail on that issue is provided in the specific comments.

Comment noted. See response to USEPA General Comment 19.

Specific Comments

3. Executive Summary, Background, Page III, and Section 1, Introduction, Page 1-1: The introduction paragraphs of the Executive Summary and Section 1 state "Radiological surveys and remediation were previously conducted at Hunters Point Naval Shipyard (HPNS) as part of a basewide Time-critical Removal Action (TCRA) in accordance with the Action Memorandum (Navy, 2006)." Please clarify this broad statement since radiological surveys and remediation activities were also performed at HPNS prior to 2006. For example, if true, the sentence could be clarified by inserting 'Parcel G': "Radiological surveys and remediation were previously conducted at Hunters Point Naval Shipyard (HPNS) [Parcel G] as part of a basewide Time-critical Removal Action (TCRA) in accordance with the Action Memorandum (Navy, 2006)." That way it is clear that Parcel G work was all done after 2006 (if true).

The text was simplified to eliminate confusion.

4. Executive Summary, Soil Investigations, Page IV and Figure ES-1, Soil and Building Sites: The text states that the approximate size and boundary of the TUs and SUs are shown on Figure ES-1. Please consider revising to state that the buildings and former buildings (of interest for this study) and the storm drain and sanitary sewer trench outlines are shown on Figure ES-1. Or consider deleting this sentence as TUs and SUs are not specifically identified on Figure ES-1. Or you could insert a Figure like 3-1 that does identify TUs and SUs?

The sentence was deleted.

5. Section 2, Conceptual Site Model, last sentence of the second paragraph: If the results were based on the 186 keV photopeak then, in our opinion, they were biased high in all cases from the presence of naturally-occurring U-235 and you could emphasize that point by striking the word "often".

Agreed. The text was revised as suggested.

6. Section 2, Conceptual Site Model, Table 2-1, last section on uncertainties, fourth main bullet: Please revise as follows to provide the important distinction that Navy activities "potentially" contributed: "... are present at HPNS because of global fallout..., in addition to being potentially present due to Navy activities".

The text was revised as suggested.

7. Table 2-1, Conceptual Site Model, Radionuclides of Concern for Parcel G (from Table 8-2 of HRA): Table 2-1 identifies ROCs for interior surfaces at former Buildings 364 and/or 365 as ^{60}Co , ^{232}Th , ^{235}U , and ^{239}Pu . Given that these buildings have been demolished is the intention that these ROCs be investigated as part of the planned soil survey unit investigation or will (some of) these ROCs be excluded from the proposed analytical suite? Please explain reasoning for including or excluding select ROCs. Table 3-4 identifies the ROCs for the Former Buildings 317/364/365 Site as ^{137}Cs , ^{226}Ra , ^{90}Sr , ^{239}Pu (excluding ^{60}Co , ^{232}Th , and ^{235}U). If these are the only ROCs being tested then Table 2-1 might need to state that sites where buildings have since been demolished will only be investigated for the Table 3-4 radionuclides and not this full historical list of radionuclides that might have been in the buildings before demolition.

A footnote has been added to Table 2-1 to note that the soil and building investigations are based on the ROCs in Table 3-4 and 4-1.

8. Table 2-1, Conceptual Site Model, Uncertainties:

- a. Bullet 1, sub-bullet 3: We note that the pipes were often reported as “crushed” or “disintegrated” and sent to the RSY pads along with soil. Therefore, it is unclear whether all pieces of pipelines were removed if they disintegrated and were indistinguishable from the soil. Although it might be difficult, is there a percent that can be attached to the report of “disintegrated” pipes so the sub-bullet can have that clarified?

The percentage of disintegrated pipes is assumed to be negligible, and if still present, disintegrated pipes will be investigated as part of this work plan.

- b. Bullet 1, sub-bullet 7: Can you clarify the implication that LLRW bins were tested by the Navy’s independent waste broker at an offsite laboratory using 5-point composites, and only 3 out of 1,411 bins had results with ²²⁶Ra above the RGs. Were these soils still disposed of as LLRW?

The discussion in sub-bullet 7 was meant to illustrate that the overall risk presented by the soil with elevated individual Ra-226 sample results is very low. Consistent with Navy procedures, the soils were disposed as LLRW.

9. Section 3.3, Remediation Goals: Table 3-5 includes a soil RG for Pu-239 and the accompanying text states that “soil data will be compared to the RGs ...” Table 3-4 implies that Pu-239 is a ROC for just soils associated with specific building sites. Please clarify whether Pu-239 is considered a ROC for all soils, or just some soils.

Pu-239 is only an ROC at the Former Buildings 317/364/365 Site, and a footnote was added to the table for clarification.

10. Section 3.3.1, Investigation Levels, second paragraph: An investigation level should indicate when a measurement indicates activity that is encroaching upon or exceeds an applicable RG. Why would that vary with a survey unit classification?

The text was removed.

11. Section 3.3.1: Investigation Levels: Please add some discussion somewhere in the work plan regarding compensatory measures that will be used to identify small areas of elevated activity or locations where biased samples should be collected for ROCs that cannot be detected via gamma scanning. The plan points out that the RG for Cs-137 is indistinguishable from the local background and cannot be detected as a contaminant because the scan techniques lack sufficient sensitivity. Sr-90 likewise cannot be detected by a gamma scan because it is a Beta-only emitter, however, when the Sr-90 is still contained within a metal housing the energy travelling through the metal can sometimes emit a signal that is detectable by the gamma scan technology.

Small areas of elevated activity will be identified by gamma scanning. Demonstrating compliance with the Cs-137 and Sr-90 RGs will be based on soil sample analytical results in comparison to the RGs and background. The text was updated for clarification.

12. Section 3.3.1, Investigation Levels, Page 3-3, and Section 3.6.3.1, Automated Soil Sorting System Process, page 3-14: Section 3.3.1 states soil gamma scan survey measurement investigation levels are not applicable for 137Cs based on a detection limit of less than 0.113 pCi/g (Residential Soil Remediation Goal (RG) prior to addition of background); however, Section 3.6.3.1 states that the large-volume gamma spectroscopy detectors proposed under the automated soil sorting system process are capable of monitoring 137Cs. Are the automated soil sorting system detectors capable of detecting 137Cs at the RG? If not, please clarify in the text the scanning capabilities.

The soil sorting system that is selected to perform the work must be capable of monitoring the gamma-emitting ROCs including Ra-226 and Cs-137. The minimum requirements for the soil sorting system detectors, MDCs, and diversion settings were added to the work plan. The specific soil sorting configuration will be provided in a separate Soil Sorting Operations Plan by the contractor who is performing the Parcel G investigation. It is not expected that the soil sorting system will be able to confidently detect Cs-137 at 0.113 pCi/g in an individual measurement; therefore, demonstrating compliance with the Cs-137 RG will be based on soil sample analytical results in comparison to the RG and background.

13. Section 3.4.4, Phase 1 Trench Unit Design, Page 3-5: We note that segregated over-excavated material may ultimately be mixed with soil from the TU following testing upon return to the origin trench.

Comment noted.

14. Section 3.4.4.1, Nomenclature of Phase 1 Trench Units, Page 3-5: Should the example for former TU-153 be “HPPG-SFU-153A” instead of “SFU-153A”?

Yes, and the text was corrected.

15. Section 3.5.1, Soil Gamma Scanning Instruments: Will the isotope-specific Region of Interest data from the gamma scanners be available in real-time, or via post-processing? It seems unlikely that a scan measurement would have sufficient sensitivity for the Bi-214 peak or for Cs-137 at a concentration near the RG. Indeed, Section 3.1.1 states that the Cs-137 RG cannot be detected by scanning. How will scan data for those Region of Interest be interpreted or used?

See response to USEPA Specific Comment 11.

16. Section 3.6.3.2, Radiological Screening Yard Pad Process: states excavated soil will be screened for compliance with the RGs given in Table 3-5. The ROCs in Table 3-5 include Sr-90 and Pu-239, in addition to Cs-137 and Ra-226. Elsewhere in the work plan it is stated that the ROCs for trench unit soils are limited to Sr-90, Cs-137, and Ra-226. Please clarify whether Pu-239 is considered a ROC for trench unit soils (presumably not), and the role of scanning with respect to showing compliance for Sr-90. Will all soil samples be analyzed for Sr-90 in addition to gamma spectrometry?

Per Table 3-4, Pu-239 is considered an ROC only for surface soil associated with the Former Buildings 317/364/365 Site. As described in Section 3.7, a minimum of 10 percent of systematic samples will be analyzed for Sr-90. Demonstrating compliance with the Sr-90 RG will be based on soil sample analytical results, and this was clarified in the work plan.

17. Section 3.7, Radiological Laboratory Analysis: This section of the plan states that only 10% of the samples will be analyzed for Sr-90, plus any that show Cs-137 at or above the RG. It also states that Pu-239 analyses will only be done if both Cs and Sr are found to be above their respective RGs. Elsewhere it is implied that all samples will be analyzed for all ROCs. It would be helpful if the plan did a better job specifying which RGs are applicable to which soils and how compliance with those concentrations is going to be demonstrated.

The work plan was reviewed and updated for consistency.

18. Section 3.7, Radiological Laboratory Analysis: Unless separate analyses are intended, clarify that the 21-day ingrowth is only germane for the Ra-226 analysis via gamma spectroscopy, but that analysis will also include concurrent quantification of Cs-137.

Section 3.7 has been revised to note that the gamma spectroscopy data for all gamma-emitting ROCs (including Cs-137) will be reported following the 21-day ingrowth.

19. Section 3.7, Radiological Laboratory Analysis, Page 3-21: Please support the decreased frequency of analysis for the site-specific ROCs 90Sr and 239Pu.

The analysis frequency of Sr-90 and Pu-239 is based on the assumption that, if present, they will be collocated with Cs-137. Elevated Cs-137 results will trigger Sr-90 and Pu-239 analysis for the sample.

20. Table 4-2: Can you clarify that the RG for structures for Th-232 is less than that for Pu-239?

Per the 2006 Action Memorandum for HPNS, the structures RG for Th-232 is 36.5 dpm/100 cm² and that for Pu-239 is 100 dpm/100 cm².

21. Section 4.5.7.2, Scan Investigation Levels: If the SCM is to be used would it not make more sense to use the images from the SIMS output to identify areas where static measurements should be collected? It is recognized that data would not be available in real-time, but it can be produced in a reasonable amount of time and would be a more reliable indicator.

True, and that is the intended approach. During the investigation, alpha and beta scan data will be collected in buildings and will be reviewed. The data will be used to calculate the survey unit-specific number of static samples required to provide enough prospective power as if the WRS test were going to be used. The work plan has been revised to provide more clarity on this topic.

22. Section 5, Data Evaluation and Reporting: Where recorded, spatially-correlated data should also include modern visualizations and not just be limited to “dumbed-down” plots to match the antiquated methods described in the MARSSIM. Spatial visualizations provide much better sensitivity with respect to identifying artifacts.

The text was updated to include spatial visualizations of spatially correlated data in the report.

23. Section 5.3.1, Identify Potential Areas of Elevated Activity, states “Any sample or measurement exceeding a ROC-specific RG will be investigated as an area of elevated activity.” Elsewhere in the work plan it is stated that such exceedances will be deemed a non-conformance with the remedial action objectives rather than treated as an area warranting further investigation. This appears to be an inconsistency that needs to be reconciled.

The investigation process will proceed as described in the revised DQOs in Sections 3 and 4, and language in Section 5 and throughout the document has been updated to be consistent with this approach.

24. Section 5.4, NORM Background Evaluation: Any sampling area that represents the background concentration will necessarily have individual results that exceed the average. Indeed, roughly 50% of them will. We think it is scientifically valid to compare the two data sets (reference area and the area under test) as distributions.

Comment noted. Section 5 has been revised to clarify the NORM evaluation process.

25. Section 5.4, NORM Background Evaluation, first sentence of second paragraph: We suggest strengthening the statement that the Ra-226 background varies all over the site with the fact the Ra-226 background varies all over the Bay Area and all over the United States. There are numerous examples of data that can be cited to further emphasize that point.

Agreed. Discussion of other background data sources that may be applicable to HPNS and criteria for their use have been added to the Soil Reference Background Area Work Plan, Section 4.

26. Section 5.4, NORM Background Evaluation: The statement that U-238 is an “acceptable representative” of uranium series decay progeny cannot be tacitly assumed. That is an oversimplification based in a textbook situation where equilibrium exists. Uranium series disequilibria are common in reality. Radium, thorium, and uranium have different solubilities, and their solubility or soil adhesion characteristics can vary with pH. Any loss of decay progeny through a process other than radioactive decay will break the equilibrium. Preferential depletion or enrichment of U-234 relative to U-238 in geological samples is a well-known phenomenon. Geologic studies showing Th-230 concentrations in excess of the corresponding U-234 concentrations are reported in the literature, as are cases of substantial enrichment of radium relative to the local uranium concentrations. Assuming equilibrium between Ra-226 and U-238 to determine whether or not a given Ra-226 assay represents background has not played out for samples we have reviewed. Indeed, we have seen data from verified clean import samples from the Half Moon Bay area (i.e. available in public documents) that showed Ra-226 concentrations that exceeded the uranium concentration by a wide margin. The samples we are referring to were analyzed via different analysis methods and involved disparate sample volumes so that may factor into the apparent non-equilibrium. In contrast, non-impacted soil samples collected from Treasure Island (i.e. available in public documents) have shown the opposite, i.e. uranium and thorium concentrations that were significantly higher than the corresponding Ra-226. At a minimum we urge that the proposed NORM analyses should include Th-230 and U-234, in addition to U-238 and Ra-226, for the same aliquant. That would at least provide a better indication if an equilibrium condition existed.

See response to USEPA General Comment 19.

27. Section 5.5, Reference Background Area Soil Data, Equation 5-1: It seems there should be some evaluation of the median relative to the mean or other consideration of the shape of the underlying distribution before applying its median in this fashion.

Equation 5-1 has been removed with the discussion on determining representativeness of RBA data sets. Section 5 has been revised to clarify the process for data evaluation.

28. Section 7.1, Project Waste Descriptions: Consider revising the first sentence to state that wastes generated “may” be radiological in nature instead of “will be.” Or will wastes be deemed radiological by default, without verification?

Agreed. The text was revised as suggested.

29. Appendix A, Soil Reference Background Area Work Plan: Selecting additional offsite areas for sampling would go a long way toward demonstrating the variability in background. These additional characterizations would not be for the purpose of defining reference areas, but would serve to emphasize the range of local backgrounds and the fact the current RGs might fall within those ranges. The Bay Area was blessed with a remarkably low average background, but instead of using that as an advantage it sometimes has been turned into a detriment for this project when the true range of background variability was not always analyzed. We have reviewed two sets of samples collected from Half Moon Bay that provide a good example. The results showed very different Ra-226 concentrations, with the concentrations from the first set significantly exceeding those from the second. The first set of five samples averaged 1.65 pCi/g Ra-226. The second set, consisting of two composite samples, averaged 0.63 pCi/g, more than a factor of two less than the first set. That sort of variability is not unusual and should be accounted for in any radiological evaluations performed at HPNS.

Additional research will be performed to identify other offsite areas that may be suitable as RBAs. If additional areas are selected for sampling, or if other background data sets are identified, justification will be provided in the report.

30. Appendix A, Soil Reference Background Area Work Plan: We recommend including some brief discussion why a RBA was not identified for Parcel G, e.g. ground covering, not an impacted area, etc.

Parcel G was initially part of Parcel D and is adjacent to the Parcel D-2 RBA; therefore, the Parcel D-2 RBA is assumed to be representative of site conditions. The text has been revised to provide additional information on the suitability of the selected RBA areas including this explanation.

31. Appendix A, Soil Reference Background Area Work Plan, DQOs Step 5: If RBA data sets end up being combined that would seem to counter the argument that HPNS is comprised of materials from various origins. Will additional RBAs be identified if the initial data sets are found to be statistically indistinguishable?

Additional RBAs may be identified and sampled if necessary.

32. Appendix A, Section 3.1, Survey Design, third paragraph: The samples from the offsite RBA location should also be analyzed for primordial isotopes and decay series in addition to fallout radioisotopes. Offsite areas should be a focal point to emphasize the variabilities that exist in natural radioelement concentrations. Any primordial series disequilibria observed in the offsite sample data should likewise be emphasized.

Agreed. See Table 3-6.

33. Appendix A, Section 3.1, Survey Design, third paragraph: An evaluation of the relative amounts of the uranium series isotopes U-238, U-234, Th-230, and Ra-226 for each RBA soil sample should be included in addition to the statistical evaluations described so that any departures from equilibrium conditions are identified and accounted for. These assays should be performed from the same or similar-sized aliquants to minimize biases.

Agreed. Where possible, alpha spectroscopy analyses on the uranium decay series alpha emitters should originate from the same sample aliquot. The SAP specifies this requirement.

34. Appendix A Table 3-1 seems to contradict earlier statements that RBA soils will be analyzed for Sr-90, Cs-137, and Ra-226. The table implies that Pu-239 will also be included in those analyses.

Table 3-1 has been removed.

35. Appendix A Section 3.1, Survey Design: If the isotopes and RGs listed in Table 3-2 do not apply globally to all soil units at HPNS then that needs to be discussed and clarified. The ROCs in Table 3-2 differ from those cited in the main body of the Parcel G work plan, which itself seems inconsistent regarding the applicable ROCs for various areas.

Clarification text has been added to indicate that the RBA characterization is intended to analyze ROCs across all parcels at HPNS.

36. Appendix A, Section 3.1.7, Laboratory Analysis: Please confirm if all RBA samples are to receive all of the analyses listed in Table 3-6. If not, then the specific analyses intended for each sample needs to be documented in the SAP or the work plan or both.

Yes, confirmed.

37. Appendix A, Section 4, Data Evaluation and Reporting: The background data analyses and conclusions for each data set or combination of data sets should also address the observed degree of equilibrium (or magnitude of any disequilibria) for the important members of primordial series decay chains (e.g. U-238, U-234, Th-230, and Ra-226).

The Soil Reference Background Area Work Plan Section 4 has been revised to require alpha spectroscopy for U-238, U-234, Th-230, and Ra-226 to evaluate the equilibrium status of the uranium natural decay series in order to assist in the comparison of Ra-226 results with background.

Minor Comments

38. Table 2-1, Conceptual Site Model, Site Location Section: Typo “comer” should be “corner”.

This typo has been corrected.